

CLASS 165, HEAT EXCHANGE**SECTION I - CLASS DEFINITION**

This class includes apparatus or process not provided for in other classes for transferring heat, or apparatus or process not provided for in other classes relating to an auxiliary device particularly adapted to be used with such heat transfer apparatus.

- (1) Note. A patent including a claim having nominal recitation of structure external to this class in combination with significantly claimed heat transfer apparatus of this class is included in this class. A patent including a claim having significant recitation of structure external to this class is excluded from this class unless specifically provided for in this class. See Subclass References to the Current Class, below, for a subclass reference for a combination of a vehicle structure and significantly claimed heat transfer apparatus, and for a combination of a building structure and significantly claimed heat transfer apparatus.
- (2) Note. Method of repairing, making, or assembling a heat exchanger is not provided in this class but is classified in an appropriate manufacturing class.
- (3) Note. Any process claim appropriate for this class are classified in the subclass providing for structure used in the process.

SECTION II - SUBCLASS REFERENCES TO THE CURRENT CLASS**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 3, for heating and cooling including addition or removal of water vapor from air.
- 41+, for a combination of a vehicle structure and significantly claimed heat transfer apparatus.
- 47+, for a combination of a building structure and significantly claimed heat transfer apparatus.
- 58, and 200, see note for the line between Classes 62 and 165.
- 58+, for a heating and cooling system with an ancillary separator.
- 200, see "note" for the line between Class 165 and related art.

SECTION III - REFERENCES TO OTHER CLASSES**SEE OR SEARCH CLASS:**

- 34, Drying and Gas or Vapor Contact With Solids, appropriate subclasses. See Lines With Other Classes and Within This Class in the class definition of Class 34 for the line.
- 62, Refrigeration, appropriate subclasses, for processes limited to refrigeration and apparatus having features specialized to refrigeration. In general if the heat exchanging means is such that it is adapted for interchangeably or convertibly heating or cooling it is not specialized to refrigeration. For example, features such as ice supports, material phase changing means (refrigeration producers), atmospheric condensate handling or an article handler with means peculiar to refrigerating the article would be considered specialized to refrigeration. As to structure adapted to both heat and cool, see Subclass References to the Current Class in this class (165). See Subclass References to the Current Class for a subclass reference to the line between Classes 62 and 165.
- 65, Glass Manufacturing, subclasses 512+ for specialized cooling of newly formed glass fibers or filaments; subclasses 509+ for specialized heating of newly formed glass fibers or filaments; subclasses 348+ for means specialized to the cooling of manufactured glass products; subclasses 484+ for means specialized to exchange heat in a fiber or filament forming operation and appropriate subclasses for processes or means specialized to the application of or removal of heat in glass manufacturing.
- 95, Gas Separation: Processes, for processes of gas separation including heat exchange. Cold wall-hot wall thermal diffusion processes will be found in Class 95, subclass 289. Class 165 will take processes where only indirect heat exchange is involved, whether or not gas separation is said to occur. See Subclass References to the Current Class in this class (165) for a subclass reference for heating and cooling including addition or removal of water vapor from air.
- 96, Gas Separation: Apparatus, for apparatus for gas separation including a heat exchanger. Cold wall-hot wall thermal diffusion apparatus will be found in Class 96, subclass 221. Class 165 will take apparatus where only indirect heat exchange is involved, whether or not gas separation is said to occur. See Subclass Refer-

- ences to the Current Class in this class (165) for a heating and cooling system with an ancillary separator.
- 99, Foods and Beverages: Apparatus, appropriate subclasses for food treating apparatus having heating or cooling means combined with additional apparatus specialized to food.
- 100, Presses, subclasses 92+ for presses means to heat, cool or dry the material.
- 122, Liquid Heaters and Vaporizers, subclasses 32+ for an indirectly heated closed liquid container with an internal vapor separator, and appropriate subclasses for a closed liquid heating vessel with a heat generator and for an accessory or element that of necessity must form a part of the liquid heating combination.
- 126, Stoves and Furnaces, subclass 33 for a stove with a steam table; subclasses 204+ for a body warmer: subclasses 226+ for a tool heater; subclass 247 for a frictional heater; subclasses 263.01+ for a chemical reaction type heater; subclasses 561+, 569+ and 714 for a solar heater; subclass 343.5 for a melting furnace; and appropriate subclasses, for open liquid heating structures not equally adapted for cooling, for heating stoves, for means for the application of heat for house warming and cooking purposes, and for specialized accessories and elements of such means.
- 137, Fluid Handling, subclasses 334+ particularly subclass 340 for fluid handling apparatus combined with means to heat or cool a part of the system or its contents by a heat exchange.
- 138, Pipes and Tubular Conduits, subclasses 37+ for general utility pipe having flow regulator or baffle.
- 159, Concentrating Evaporators, appropriate subclasses, for means for the generation and transfer of heat of the specific purpose of concentration by evaporation.
- 196, Mineral Oils: Apparatus, subclasses 104+ for a still designed for mineral oil distillation and subclasses 138+ for condensing peculiarly adapted and limited to the mineral oil art.
- 202, Distillation: Apparatus, subclasses 163+ and 232+ for apparatus for volatilizing a substance for the purpose of recovering material from the vapor by condensation or absorption.
- 203, Distillation: Processes, Separatory, subclass 41 and 42, for a process of volatilizing a substance and recovering material from the vapor by some type of sorption.
- 210, Liquid Purification or Separation, subclasses 175+, 612+, 664, 737, 742, 766, and 774 for processes and apparatus of that class with heat or heat exchange.
- 219, Electric Heating, appropriate subclasses for an electric heater or an electrically heated tool.
- 221, Article Dispensing, subclass 150 for subject matter of that class with cooling or heating.
- 222, Dispensing, subclass 146 for dispensers with heating or cooling means.
- 236, Automatic Temperature and Humidity Regulation, subclass 44 for automatic humidity controlling mechanism; subclass 46 for temperature or a humidity controlling mechanism including a timing means; and appropriate subclasses for a temperature or humidity control mechanism for a control of general utility. The line between Class 165 and 236 is: Class 165 takes: (a) Nominal recitation of a means for heating and cooling, and a means for automatically controlling the means for heating and cooling. (b) Specific heat exchanger structure in combination with a means for automatically controlling a heat exchanger. (c) Specific heat exchange structure in combination with a means for automatically controlling a heating and a cooling means. Class 236 takes: A patent with nominal recitation of a heat exchanger in combination with a means for automatically controlling a heating or cooling means.
- 237, Heating Systems, subclasses 70+ for a heat distributing means peculiarly adapted for heating, and appropriate subclasses for (1) a heat producer combined with means for distributing a fluid heated thereby and (2) apparatus including systems for heating a room, chamber, house or other inclosing structure when such apparatus is not equally adapted for cooling. See Subclass References to the Current Class for a subclass reference to the line between Classes 237 and 165.
- 239, Fluid Sprinkling, Spraying, and Diffusing, subclass 13 and 128+ for processes and apparatus of that class with heating or cooling.
- 241, Solid Material Comminution or Disintegration, subclass 23 and 65+ for processes and apparatus of that class with heating or cooling.
- 252, Compositions, particularly subclasses 67+ and 71+. Patents are placed in Class 252 (1) claiming admixtures of ingredients, or claims to an old compound limited to use as a heat exchange agent, (2) processes of heat exchange comprising known heat exchange steps broadly

- recited and distinguished solely by the composition or compound used, and (3) apparatus with the composition or compound therein, where characteristics of apparatus structure are not claimed. The preceding are placed in Class 252 even though freezing or boiling points or temperatures of use are specified.
- 261, Gas and Liquid Contact Apparatus, appropriate subclasses for apparatus specially adapted to produce an intimate contact between gases and liquids to exchange properties or mutually modify conditions; particularly, subclasses 127+ for a gas liquid contact device with an immediately associated means for externally supplying heat to or removing it from a contact fluid before, after or during contact to perfect the contact operation; and subclasses 158+ for a contact device in which heat is interchanged between contact fluids out of contact before, after or during contact.
- 291, Track Sanders, subclasses 19+ for subject matter of that class with a heater.
- 312, Supports: Cabinet Structure, subclass 236 for the combination of a cabinet and a heater or heat exchanger, having no feature relating to the promotion or control of the flow of the fluid in the cabinet relative to the heat exchanger.
- 366, Agitating, appropriate subclasses for agitating process or apparatus of general utility; subclasses 144+ for an agitator in combination with a heating or cooling means. The line between Classes 165 and 366 on combined agitator and heat exchanger is:
- (a) Class 165 takes: (a) All patents with significant heat exchange structure in combination with nominal structural recitation of an agitator. (b) All patents with a heat exchanger having an agitator which operates on a working fluid (e.g., a coolant or heating fluid), whether or not the agitator structure is broadly or significantly claimed. (c) All patents with a heat exchanger having a working fluid (e.g., a coolant or heating fluid) which goes through the inside of a movable portion of an agitator, whether or not the agitator structure is broadly or significantly claimed
- (b) Exception to the above statements (b) and (c): Patents in which a working fluid is agitated by an agitator and then allowed to be mixed in a mixing chamber containing a material or fluid to be treated (heated or cooled) are classified in Class 366.
- (c) Class 366 takes: (a) Significant agitator structure in combination with significant structure of a heat exchanger. (b) Significant agitator structure in combination with nominal structure of a heat exchanger.
- (d) Exception to the above statements (a) and (b): A patent with a heat exchanger having a working fluid (a coolant or heating fluid) which goes through the inside of a movable portion of an agitator is classified in Class 165, whether the agitator structure is significantly or broadly claimed. Class 366 takes a heat exchanger having an agitator which operates on a working fluid only if the working fluid is then allowed to flow into a mixing chamber containing a material or fluid to be heated or cooled.
- 373, Industrial Electric Heating Furnaces, appropriate subclasses for electrical furnaces.
- 376, Induced Nuclear Reactions: Processes, Systems, and Elements, subclasses 210+, 298+, 322, 378+, and 402+, for heat exchange devices used in combination with nuclear reaction systems.
- 383, Flexible Bags, for hot water and ice bags, per se.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclass 305 for fume generators.
- 426, Food or Edible Material: Processes, Compositions, and Products, appropriate subclasses.
- 432, Heating, appropriate subclass, for a residual material heating apparatus or method.
- 454, Ventilation, appropriate subclasses for apparatus for supplying air to, removing it from, or distributing in an enclosure with or without heating and without a specific heat exchange means.
- 4 This subclass is indented under the class definition. Apparatus comprising a non-fluent heat storing mass that in alternation has heat added to it by one fluid stream and removed from it by another.

SUBCLASSES

- SEE OR SEARCH THIS CLASS, SUB-CLASS:
104.11+, for a fluent material forming part of the heat transfer apparatus that recycles between two zones picking up heat at one zone and discharging it at another.
- SEE OR SEARCH CLASS:
62, Refrigeration, subclass 638, 641 for a process specialized to liquid gas production utilizing a regenerator and subclasses 644+ for a liquefied gas producer having a gas treater upstream of a rectifier that may be of the regenerative type.
137, Fluid Handling, subclasses 309+ for a regenerative system consisting of reversing valves and only the fluid passages of the regenerator.
202, Distillation: Apparatus, subclass 123, for a vertical thermolytic retort with a regenerator and subclasses 141+, for a horizontal thermolytic retort having vertical flues and reversible regenerators.
432, Heating, subclass 39, for the automatic control of the selection or load balancing of furnace exhaust heated regenerators; 40, for the automatic control of a Cowper stove; 54, for residual heating apparatus with an interlocked, interconnected or multi-way controller alternating flow of heated and heating fluid; 70, for residual heating apparatus with a slag or dust separator at a regenerator or recuperator; and 80 for a residual furnace in which the work chamber exhaust heats the work chamber feed by a regenerative type heat exchanger.
- 5** This subclass is indented under subclass 4. Apparatus wherein provision is made for the cleaning of the heat storage mass.
- 6** This subclass is indented under subclass 4. Apparatus wherein the heat storage mass is movable first into one of the fluid streams and then into another of the streams and there is an enclosing support for the mass with inlets and outlets for the exchanging streams.
- 7** This subclass is indented under subclass 6. Apparatus with fluid handling elements additional to the mass and its enclosing support.
- 8** This subclass is indented under subclass 6. Apparatus in which the two streams pass through circumferentially spaced parts of the mass, which is rotatable.
- 9** This subclass is indented under subclass 8. Apparatus having provisions for preventing leakage of the fluid flowing through the rotary mass.
- SEE OR SEARCH CLASS:
285, Pipe Joints or Couplings, subclasses 95+ for a coupling with a fluid pressure seal, and subclasses 335+ for a packed pipe joint.
- 9.1** This subclass is indented under subclass 4. Apparatus comprising a heat storage mass made up of plural, shaped, modular units of refractory material arranged to form an open-work structure of interconnected passages; or a module, per se, if particularly adapted for use in such a mass.
- SEE OR SEARCH CLASS:
52, Static Structures (e.g., Buildings), subclass 574 for an assembly of alternating, reversed identical form modules of general utility; subclasses 578+ for a general utility assembly of modules with a discrete edgewise connecting feature; and subclasses 596+ for a module of general utility having inter-relating structure.
202, Distillation: Apparatus, subclass 111, 122, 123, 130, 140, 143, 144, 146, 148, and 267 for regenerative heating devices used in stills.
266, Metallurgical Apparatus, subclass 139 for metallurgical apparatus provided with a gas heater of the heat storage type.
432, Heating, subclass 28 for a process of utilizing or operating a heat storage mass; subclass 51 for the timing, programming or cycling control of heat storage masses; subclass 54, for the intercontrol of heated and heating fluid to a heat storage mass; subclass

- 70, for a heat storage mass having a lint, dust, or slag separator or collector; subclasses 180+ for a combustion products heated furnace in which the chamber exhaust heats the chamber feed by means of a heat storage mass; subclass 214, for a heat storage mass of solid material combined with a heat generator.
- 9.2** This subclass is indented under subclass 9.1. Apparatus in which the modular units are (1) arranged to form a flow passage increasing or decreasing in size along the assembly or (2) are formed of different material along the direction of flow providing progressive resistance to damage by heat or having progressive heat storing characteristics.
- 9.3** This subclass is indented under subclass 9.1. Apparatus with means forming a distinct fluid distributing or collecting chamber at an end of the heat storage mass.
- 9.4** This subclass is indented under subclass 9.1. Apparatus in which the modular units are arranged in a gas confining shell.
- 10** This subclass is indented under subclass 4. Apparatus relating to the structure of the heat storing mass.
- 11.1** **WITH ALARM, INDICATOR, SIGNAL REGISTER, RECORDER, TEST OR INSPECTION MEANS:**
This subclass is indented under the class definition. Apparatus with an alarm, indicator, register, recorder, signal or tester; or with means which permits inspection of normally hidden parts of the apparatus or of the fluid inside the apparatus.
- SEE OR SEARCH CLASS:**
62, Refrigeration, subclasses 125+ for a refrigerating system with an indicator or tester.
73, Measuring and Testing, appropriate subclasses for a measuring or testing device, per se.
- 11.2** **Remotely controlled inspection means:**
This subclass is indented under subclass 11.1. Apparatus which the inspection means is manipulated from outside the heat exchanger by an operator.
- 41** This subclass is indented under the class definition. Apparatus having (1) means dependent on vehicle motion, (2) a defined vehicle traction feature, or (3) a defined vehicle body feature other than that merely forming the structure enclosing a space to be heated or cooled or supporting a heating or cooling means.
- SEE OR SEARCH THIS CLASS, SUBCLASS:**
202+, and 271, for control means responsive to vehicle motion.
234+, where the vehicle is an aircraft having means to compensate for variations in ambient pressure.
- SEE OR SEARCH CLASS:**
62, Refrigeration, subclasses 239+ for a vehicle having refrigerating apparatus not combined with heating apparatus.
152, Resilient Tires and Wheels, subclass 153 for a resilient tire with a cooling device.
237, Heating Systems, subclass 12.3 for a heating system not combined with a cooling system for a vehicle body in which the vehicle motor serves as the heat generator for the system; and subclasses 28+ for a vehicle having heating apparatus, but not cooling.
- 42** This subclass is indented under subclass 41. Apparatus having means for both heating and cooling that is more than a mere carrier for heat between a source and a sink.
- 43** This subclass is indented under subclass 42. Apparatus in which there is on the vehicle a common power supply for the vehicle and the cooling apparatus.
- SEE OR SEARCH CLASS:**
62, Refrigeration, subclass 243 for a refrigeration system installed on a vehicle with a common power supply

- for the vehicle and refrigerating system.
- 237, Heating Systems, subclass 12.3 for a combined power plant and heating system for a vehicle other than a railway car and subclasses 12.4+ for a similar structure on a railway car.
- 44** This subclass is indented under subclass 41. Apparatus including means which makes use of the motion of a vehicle to perform some function of heat exchange.
- SEE OR SEARCH CLASS:
- 62, Refrigeration, subclasses 241+ for a vehicle mounted refrigeration system utilizing the motion of the vehicle.
- 45** This subclass is indented under the class definition. Apparatus wherein the structure is related to some feature of the earth.
- SEE OR SEARCH CLASS:
- 60, Power Plants, subclasses 641.1+ for a power plant utilizing natural heat.
- 62, Refrigeration, subclass 260 for a refrigerating apparatus having a geos:graphical feature.
- 126, Stoves and Furnaces, subclasses 561+ , 569+ and 714, for a solar heater.
- 166, Wells, subclasses 57+ for heat exchange apparatus comprising part of a well apparatus for producing or treating a well.
- 175, Boring or Penetrating the Earth, subclass 17 for earth boring with means for changing the temperature of all or a portion of a bore or boring equipment within the bore.
- 299, Mining or In Situ Disintegration of Hard Material, subclasses 3+ for in situ conversion of solid to fluid for recovery of valuable material and including melting or other use of heat.
- 405, Hydraulic and Earth Engineering, subclass 56 for a method or apparatus relating to the heating or cooling of the earth surrounding an underground fluid storage cavity; and subclasses 130+ for subject matter relating to temperature modification of an earth formation.
- 46** This subclass is indented under the class definition. Apparatus comprising a nonrigid cover or applicator unit; e.g., sheet, bag, etc.
- SEE OR SEARCH CLASS:
- 2, Apparel, subclass 171.3 for a head covering with forced air circulator.
- 4, Baths, Closets, Sinks, and Spittoons, subclasses 524+ for a device for treating the body or a body member with hot air or vapor.
- 5, Beds, subclasses 421+ for beds or mattresses with heating or cooling means.
- 36, Boots, Shoes, and Leggings, subclasses 83+ for a heated boot or shoe.
- 62, Refrigeration, subclass 530 for an envelope type of cooling device.
- 126, Stoves and Furnaces, subclasses 204+ for a body warmer.
- 160, Flexible or Portable Closure, Partition, or Panel, subclass 44 for a flexible panel with liquid supplying means.
- 383, Flexible Bags, subclass 901 for hot water and ice bags.
- 428, Stock Material or Miscellaneous Articles, appropriate subclasses for a stock material product in the form of a flexible single or plural layer web or sheet.
- 47** This subclass is indented under the class definition. Apparatus with means performing an operation external to the subject matter of this class or with a static construction installation, wherein there is included only so much structure foreign to Class 165 to associate it with the apparatus of Class 165.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 41+, for a heat exchanger with a vehicle body or traction feature.
- 45, for a heat exchanger having a feature related to the earth.
- SEE OR SEARCH CLASS:
- 65, Glass Manufacturing, subclass 267 for a blow mold having heating or cooling means; subclass 319 for a press mold having heating or cooling means; and subclasses 355+ for other

- glass manufacturing apparatus having heating or cooling means.
- 68, Textiles: Fluid Treating Apparatus, subclasses 15+ for a washing machine with a tank heater.
- 72, Metal Deforming, subclass 69, 128, 200+, 286, 342, and 364, for a process or apparatus for modifying or maintaining the temperature of a machine or a metal workpiece in connection with deformation of the workpiece.
- 118, Coating Apparatus, subclasses 58+ for a coating machine with a heat exchanger treating the work.
- 119, Animal Husbandry, subclass 14.09 for a milking machine with a cooler; subclasses 302+ for a heated incubator; subclasses 311+ for a heated brooder and subclass 73 for a temperature controlled watering device.
- 126, Stoves and Furnaces, subclasses 369 through 369.3 for a steam chamber for food.
- 132, Toilet, subclasses 41.01+ for a hair device with a heater.
- 134, Cleaning and Liquid Contact With Solids, subclasses 105+ for a cleaning or liquid contact with solids apparatus with a heat exchanger.
- 141, Fluent Material Handling, With Receiver or Receiver Coacting Means, subclass 82 for a receiver filling device with material heating or cooling structure.
- 174, Electricity: Conductors and Insulators, subclasses 15.1+ for an electrical conductor or insulator with cooling structure.
- 184, Lubrication, subclasses 104.1+ for a lubricator with heating or cooling means.
- 188, Brakes, subclass 264 for a brake with a cooling and lubricating means, and subclass 274 for a fluid-resistance brake with a heat exchanger for the fluid.
- 192, Clutches and Power-Stop Control, for a clutch with a cooling and lubricating means.
- 204, Chemistry, Electrical and Wave Energy, appropriate subclasses for electrical treatment apparatus in combination with heat exchange means; especially subclass 239 and 241 for an electrolytic apparatus with a heater or cooler.
- 209, Classifying, Separating, and Assorting Solids, subclass 11 for a solid separator with heat treatment means; and subclass 238 for a sifter with heating or cooling means.
- 210, Liquid Purification or Separation, subclasses 175+ for a liquid separator with an ancillary heat exchanger.
- 215, Bottles and Jars, subclasses 12+ for a bottle or jar with a spaced wall or jacket.
- 220, Receptacles, subclass 592.05, 592.23, 592.24, 495.01+, 23.9, and 23.91 for a receptacle of that class with a spaced wall or jacket.
- 222, Dispensing, subclass 183 for dispensing apparatus with a jacket casing.
- 228, Metal Fusion Bonding, subclass 46 for apparatus for metal fusion bonding combined with cooling means and subclasses 199+ for corresponding methods.
- 241, Solid Material Comminution or Disintegration, subclasses 65+ for a solid material comminutor with a temperature modifier for the material.
- 250, Radiant Energy, subclass 238 for a photocell with temperature control means, subclass 352 for temperature controlled infrared responsive electric signalling means, subclass 429 for fluent material containment support or transfer means including temperature control of the fluent material, subclasses 493.1+ for invisible ray generator with cooling means.
- 269, Work Holders, subclass 7 for a work holder with means for solidification of the work holding medium.
- 277, Seal for a Joint or Juncture, for a generic sealing means or process, cross-reference art collection 930 for a seal having a heating or cooling feature.
- 285, Pipe Joints or Couplings, subclass 41 for a pipe joint or coupling with heating or cooling means.
- 297, Chairs and Seats, subclasses 180.1+ for a chair or seat with a heat exchanger.

- 310, Electrical Generator or Motor Structure, subclasses 52+ for a rotary electrical motor or generator with cooling means.
- 313, Electric Lamp and Discharge Devices, subclasses 11+ for an electric lamp or discharge device with a temperature modifier. See Lines With Other Classes and Within This Class in the definition of Class 313 for a statement of the line between Class 165 and Class 313.
- 314, Electric Lamp and Discharge Devices: Consumable Electrodes, subclasses 26+ for an electric discharge device of the consumable electrode type with temperature modifying means.
- 331, Oscillators, subclass 69 for an oscillator housing with a temperature modifier and subclass 70 for an oscillator with a temperature modifier.
- 336, Inductor Devices, subclasses 55+ for an inductor device with temperature modifying means.
- 338, Electrical Resistors, subclasses 53+ for an electrical resistor with cooling gas or liquid circulation.
- 361, Electricity: Electrical Systems and Devices, subclasses 676+ and subclass 688 for miscellaneous electrical apparatus not elsewhere provided for with cooling means.
- 362, Illumination, subclass 294 for a projecting lantern with cooling means.
- 366, Agitating, subclasses 22+ for a mortar mixer with a heat exchange device.
- 373, Industrial Electric Heating Furnaces, subclasses 42+ for a condenser in an electric furnace system.
- 384, Bearings, subclass 317 for a rotary bearing with cooling means.
- 409, Gear Cutting, Milling, or Planing, subclass 249 for a broaching machine with means to modify the temperature of the work or tool.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclass 186.11, 186.19 and 186.20 for ozonizers with heating or cooling means; and subclass 186.26 for arc or spark discharge reactors with cooling or pressurizing means.
- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, the appropriate apparatus subclass for the combination of heating or cooling means therewith; but see especially subclass 378.1 for an extrusion shaping machine including heating or cooling means, subclass 384 for apparatus for reshaping or vulcanizing a nonmetallic preform including both heating and cooling means, and subclass 406 for a press molding machine for non-metals including both heating and cooling means; see the search notes thereunder.
- 439, Electrical Connectors, subclasses 190+ for an electrical connector having a retainer or passageway for fluent material; and subclasses 485+ for an electrical connector with provision to dissipate, remove, or block the flow of heat.
- 494, Imperforate Bowl: Centrifugal Separators, subclasses 13+, for a separator of that class provided with means for exchanging heat.
- 48.1 Heating and cooling:**
This subclass is indented under subclass 47. Apparatus in which the installed heat exchange apparatus performs both a heating and cooling operation that is more than a mere carrying of heat between a source and a sink.
- 48.2 Solar:**
This subclass is indented under subclass 48.1. Apparatus including a solar heater or a solar cooler.
- 49** This subclass is indented under subclass 48.1. Apparatus wherein a heat exchanging element is installed as an area of a room surface.
- 50** This subclass is indented under subclass 48.1. Apparatus wherein there is a heat exchanger in each of a plurality of rooms and a fluid from a central heated or cooled supply communicates with the heat exchangers.
- SEE OR SEARCH THIS CLASS, SUBCLASS:**
205+, for automatic, interlocked plural zone and central system control.

- 51** This subclass is indented under subclass 47. Apparatus in which the heat exchanger is associated with an engine.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 43, for a heated and cooled vehicle in which the vehicle engine supplies the heat and the power to operate the heating and cooling system.

SEE OR SEARCH CLASS:

- 60, Power Plants, subclasses 320+ for treatment by heat exchange of the exhaust from the motor of a power plant.
- 123, Internal-Combustion Engines, subclass 41.01 for a device limited by structure to use as an internal combustion engine element and having associated cooling means; and subclass 142.5 for an internal combustion engine element with means using heat from one part to heat another part by exchanging heat between the parts.
- 126, Stoves and Furnaces, subclass 19.5 for a stove oven or vessel in which a combustion engine serves as the heat generator.
- 237, Heating Systems, subclasses 12.1+ for a heating system receiving heat from a power plant.

- 52** This subclass is indented under subclass 51. Apparatus in which one passage of the heat exchanger is flow connected to an engine exhaust port and another passage is flow connected to the engine inlet.

SEE OR SEARCH CLASS:

- 123, Internal-Combustion Engines, subclasses 543+ for a heated charge forming device, subclasses 364+ for an internal combustion engine with a feed oil evaporator; and subclass 142.5 for a device limited by structure to use as an internal combustion engine element with means using heat from one part to heat another part by exchanging heat between the parts.
- 181, Acoustics, subclasses 282+ for a jacket or casing, per se, for a muffler.

- 53** This subclass is indented under subclass 47. Apparatus in which the heat exchanger is installed on the wall, floor or ceiling structure of a chamber having a function external to the subject matter of this class and in which the heat exchange is incidental to the primary use of the chamber, which, for example, may be as a shelter or transportation unit.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 41, where the chamber has an associated vehicle feature.

- 54** This subclass is indented under subclass 53. Apparatus in which the heat exchanger is in a flow path that includes a passage providing communication between the inside and outside of the chamber.

SEE OR SEARCH CLASS:

- 237, Heating Systems, subclasses 46+ for a heating system with means for withdrawing stale air from the heated chamber.
- 454, Ventilation, appropriate subclasses for apparatus and processes for supplying air to or removing it from enclosures where there is neither particular structure of the heat exchanger nor any particular relationship between the heat exchanger and the enclosure ventilated.

- 55** This subclass is indented under subclass 53. Apparatus in which a covering construction is mounted on the enclosure forming structure with a portion projecting inwardly from the plane of the structure to form therewith a flow channel in which the heat exchanger is mounted.

- 56** This subclass is indented under subclass 53. Apparatus in which the heat exchanger is located in or is formed by an opening or recess in the enclosure forming structure.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 49, for a radiant building panel with heating and cooling means.

SEE OR SEARCH CLASS:

- 62, Refrigeration, subclass 451 for a refrigerator having a flow coolant container within the hollow wall of an enclosure.
- 237, Heating Systems, subclass 69 for a heating system in which an enclosure floor structure is heated.

57 This subclass is indented under subclass 56. Apparatus in which the opening or recess communicates with the chamber.

58 This subclass is indented under the class definition. Apparatus for the treatment of material additional to the parts of the apparatus by (1) selectively adding heat to or removing it from the external material, (2) simultaneously adding heat to and removing it from the same external material and (3) by adding heat to and removing it from distinct external materials where more than a transfer of heat from one of the materials to the other is involved.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 2, for heating and cooling processes.
- 42+, for a heated and cooled vehicle.
- 48.1+, for a structurally installed heating and cooling system.
- 201+, for automatically controlled heating and cooling apparatus.

SEE OR SEARCH CLASS:

- 34, Drying and Gas or Vapor Contact With Solids, subclasses 62+ and see the Notes thereto.
- 62, Refrigeration, appropriate subclasses, particularly subclass 7, 79, 90, 122, 159+, 173, 238.1+, 277+, and 324.1+, for combined heating and cooling performed by a refrigerating producing system and subclass 238.1 for a refrigeration producer utilizing a disparate heat source as an operating energy source. The line between Classes 62 and 165 on combined heating and cooling is: (1) Class 62 takes (a) a refrigeration producing system and related processes used for both heating and cooling even though the rejected heat is utilized, and (b) a refrigeration system combined with

heating means for removing or preventing the deposition of condensate (frost) or for thawing a freezing mold; (2) Class 165 takes (a) a refrigeration producer having means to convert the same to a heating system so that it no longer functions as a refrigeration producer (as by omitting the evaporator) and (b) a refrigeration producer combined with heating means not provided for under (1) above.

236, Automatic Temperature and Humidity Regulation, appropriate subclasses, for regulating a single temperature changing element to maintain plural temperatures, which single element may at some times act as a heater and other times as a cooler; see particularly subclass 1.

59 This subclass is indented under subclass 58. Apparatus including means to supply fresh air to a chamber.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 248+, for automatic ventilation control.

SEE OR SEARCH CLASS:

- 62, Refrigeration, subclass 409, 410+ and 427 for refrigerated and ventilated enclosures.

60 This subclass is indented under subclass 58. Apparatus including a gas and liquid contact device.

SEE OR SEARCH CLASS:

- 261, Gas and Liquid Contact Apparatus, subclasses 127+ for heated or cooled gas and liquid contact devices; and appropriate subclasses for other gas and liquid contact structures.

61 This subclass is indented under subclass 58. Apparatus by which a material or its container can be both heated and cooled.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 254+, for automatic selection of heating or cooling.
- 259, for devices in which a single sensor controls both heating and cooling.

- 265, for manual selection of heating or cooling combined with automatic control of the condition modifier.
- SEE OR SEARCH CLASS:**
- 34, Drying and Gas or Vapor Contact With Solids, subclasses 62+, for a drier or gas or vapor contact with solids apparatus having a means cooling the dried solids.
- 266, Metallurgical Apparatus, subclasses 121+ for metallurgical apparatus for treating solid metal with both heat and a liquid.
- 432, Heating, subclasses 77+, for a residual heating apparatus combined with structure for merely reducing the temperature of the heated work toward ambient temperature.
- 62** This subclass is indented under subclass 61. Apparatus wherein a refrigeration producing system has means to change the same to a heating system.
- 63** This subclass is indented under subclass 61. Apparatus wherein the heating and cooling means includes apparatus to cause a cooling effect by producing a change in the condition of a material, e.g., change of phase of a material.
- 64** This subclass is indented under subclass 61. Apparatus wherein the heating and cooling means includes a device by which heat is produced by transformation of energy, e.g., electric heater or burner.
- 65** This subclass is indented under subclass 61. Apparatus including a flow path having spaced heating and cooling heat exchangers.
- SEE OR SEARCH THIS CLASS, SUBCLASS:**
- 223+, for devices in which the reheating of a cooled stream is controlled by a humidistat.
- 263, for devices in which the reheating of a cooled stream is controlled by a thermostat.
- SEE OR SEARCH CLASS:**
- 99, Foods and Beverages: Apparatus, subclass 276, 277, 453+, and 470, for heat exchange apparatus in combination with food treatment apparatus.
- 66** This subclass is indented under subclass 65. Apparatus wherein there is an exchange of heat between fluid flowing toward and fluid flowing away from a heat exchanger.
- 67** This subclass is indented under the class definition. Apparatus combined with structure for supporting the apparatus or a component thereof relative to means external to the device.
- SEE OR SEARCH CLASS:**
- 248, Supports, appropriate subclasses for a support, per se.
- 68** This subclass is indented under subclass 67. Apparatus in which the supporting structure comprises elements extending downwardly from the heat exchanger for supporting it from a subjacent external surface or means.
- 69** This subclass is indented under the class definition. Apparatus wherein resilient members are placed between elements of a heat exchanger and serve to dampen vibration.
- SEE OR SEARCH CLASS:**
- 62, Refrigeration, subclass 295 for a resiliently supported power or heat rejecting element in refrigerating apparatus; and subclass 296 for a muffler or sound damper in a refrigerating apparatus.
- 248, Supports, subclasses 560+ for resilient supports, per se.
- 70** This subclass is indented under the class definition. Apparatus including means to collect material which leaks from the apparatus.
- SEE OR SEARCH THIS CLASS, SUBCLASS:**
- 11.1, for a leakage indicator.
- SEE OR SEARCH CLASS:**
- 137, Fluid Handling, subclasses 312+ for a leakage collector on a fluid handling

- system not specialized to heat exchange.
- 285, Pipe Joints or Couplings, subclasses 13+ for a leakage or drip disposal arrangement for a pipe joint not specialized to heat exchange.
- 71** This subclass is indented under the class definition. Apparatus having a discharge opening additional to the normal flow inlet and outlet of a heat exchanger and closed by a cock or plug, for removing material from a flow path of the heat exchanger.
- 72** This subclass is indented under the class definition. Apparatus having an exterior opening closed by a releasably mounted covering section.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 71, for a removable purge or drainage plug.
- SEE OR SEARCH CLASS:
- 49, Movable or Removable Closures, appropriate subclasses for a closure of the type provided for and see Lines With Other Classes and Within This Class, for the loci of closures specific to the furnace and heating classes.
- 73** This subclass is indented under subclass 72. Apparatus in which material within or flowing to or from the apparatus having the removable covering section is heated or cooled by the removable section or by a device supported by the section.
- SEE OR SEARCH CLASS:
- 202, Distillation: Apparatus, subclass 243, for a closure for a still or retort cooled by a fluid within or flowing through the closure.
- 74** This subclass is indented under subclass 73. Apparatus in which the heat exchange means extends inwardly from the access opening and provides an exchange surface within the receptacle.
- SEE OR SEARCH CLASS:
- 313, Electric Lamp and Discharge Devices, subclasses 17+ for an electric lamp or discharge device projecting into a temperature modifying jacket.
- 75** This subclass is indented under subclass 72. Apparatus in which the covered opening provides access from the exterior of a casing to space within it, in which the temperature modifying means is located.
- 76** This subclass is indented under the class definition. Apparatus including means, other than the parts making up the heat exchanger and securing them in operative relationship, which means aids in the assembly or disassembly, or restores or aids in restoring the apparatus to its former condition after injury or decay.
- (1) Note. Mere devices with disconnectable pipe joints are not repair or assembly means and are classified in appropriate subclasses below.
- SEE OR SEARCH CLASS:
- 29, Metal Working, subclasses 890.03+ for the process of making a heat exchanger or boiler and subclasses 726+ for apparatus for assembling and disassembling a heat exchanger.
- 62, Refrigeration, subclasses 298+ for refrigerating apparatus with repair, assembly or disassembly means.
- 901, Robots, appropriate subcollections for a robot device in general.
- 77** This subclass is indented under subclass 76. Apparatus including a hinge upon which a part of the heat exchanger pivots between operative and inoperative positions.
- 78** This subclass is indented under subclass 76. Apparatus wherein a supporting structure, e.g., a trackway, serves as a guide during the assembly or disassembly of parts of the apparatus.
- SEE OR SEARCH CLASS:
- 62, Refrigeration, subclass 303 for a refrigerator with repair or assembly means including sliding or rolling guides.

- 79** This subclass is indented under subclass 76. Apparatus wherein the parts are assembled by settable material and means is provided for guiding the settable material into position or retaining it in position as it sets.
- 80.1 WITH RETAINER FOR REMOVABLE ARTICLE:**
This subclass is indented under the class definition. Apparatus including means maintaining a removable article or device in position relative to tempering structure or fluid.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
72+, where the removable article or device is or includes a cover for an access opening.
- SEE OR SEARCH CLASS:
269, Work Holders, appropriate subclasses for work holders, per se.
- 80.2 Electrical component:**
This subclass is indented under subclass 80.1. Apparatus which the article is a current conducting element utilized as part of an electrical device.
- 80.3 Air cooled including fins:**
This subclass is indented under subclass 80.2. Apparatus in which heat from the electrical component is removed through structure which includes fins in an environment of stationary or moving air.
- 80.4 Liquid cooled:**
This subclass is indented under subclass 80.2. Apparatus in which cooling of the electrical component is effected by liquid coolant.
- 80.5 Including liquid heat exchange medium:**
This subclass is indented under subclass 80.1. Apparatus in which heating or cooling is effected by a liquid medium.
- 81** This subclass is indented under the class definition. Apparatus with provision for dimension variation of a heat exchanger element produced by temperature change.
- SEE OR SEARCH CLASS:
52, Static Structures (e.g., Buildings), subclass 573.1 for a building structure with means accommodating dimension variations due to changing conditions.
- 82** This subclass is indented under subclass 81. Apparatus including a non-rigid interconnection between a temperature modifying means and an associated casing or frame.
- 83** This subclass is indented under subclass 82. Apparatus wherein the interconnection includes a flexible fluid confining wall structure, e.g., a bellows.
- 84** This subclass is indented under the class definition. Apparatus having means by which a wall through which heat is transferred is intermittently flexed or distorted.
- SEE OR SEARCH CLASS:
15, Brushing, Scrubbing, and General Cleaning, subclass 104.07 for a pipe and tube cleaning hammer and subclass 104.08 for a device for cleaning a pipe or tube by deforming it.
- 85** This subclass is indented under the class definition. Apparatus in which a mechanically driven impeller or agitator is operated by the force or pressure of the material or of the material with which it exchanges heat.
- 86** This subclass is indented under the class definition. Apparatus comprising a heat exchange device with movably supported surface means, said movable surface means being exposed for contact with material to be heated or cooled by the surface.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
44, for a heat exchanger carried through a fluid by movement of a supporting vehicle.
73, for a temperature modifier carried by a removable cover for an access opening.
84, for a vibrating temperature modifier.

SEE OR SEARCH CLASS:

- 62, Refrigeration, subclasses 345+ for a congealed product producer having a freezing surface mounted for movement during freezing; subclasses 448+ for a unit of a refrigeration producing assembly movably associated with an enclosure; and subclass 499 for a unitarily movable evaporator and condenser.
- 159, Concentrating Evaporators, subclasses 7+ for a concentrating evaporator with a moving support for an evaporating film.
- 432, Heating, subclasses 135+, for an apparatus including a heat generator and a traveling heat emitter carrying or stirring work material.
- 87** This subclass is indented under subclass 86. Apparatus wherein the movable surface means is a part of a hollow rotating device and said surface is in the plane of a helix about the axis of rotation of the device.
- SEE OR SEARCH CLASS:
- 416, Fluid Reaction Surfaces (i.e., Impellers) subclasses 96+ for a hollow rotary impeller with a heat exchange medium therein.
- 88** This subclass is indented under subclass 86. Apparatus including a rotatable device having within it separate flow paths for exchanging fluent materials.
- SEE OR SEARCH CLASS:
- 34, Drying and Gas or Vapor Contact With Solids, subclasses 130+ for a rotary drum drier with gas or vapor flow, and treated material flow, and heating means.
- 89** This subclass is indented under subclass 86. Apparatus in which the movable heat transfer surface means comprises a part of a wall of a cylindrical tank device mounted for rotation about the axis of the cylinder.
- SEE OR SEARCH CLASS:
- 34, Drying and Gas or Vapor Contact With Solids, subclasses 108+ for a rotary drum type drier.
- 62, Refrigeration, subclass 346 for a rotary drum type material concealer.
- 72, Metal Deforming, subclass 69, 128, 200+, 286, 342, and 364 for a process or apparatus for modifying or maintaining the temperature of a machine or a metal workpiece in connection with deformation of the workpiece.
- 159, Concentrating Evaporators, subclass 11 for a film type concentrating evaporator having a rotary drum or disc.
- 432, Heating, subclasses 103+, for a tumbler type rotary drum including a heat generator, or otherwise specialized to the application of heat to work material.
- 492, Roll or Roller, subclass 46 for a roll, per se, not elsewhere provided for, having heating, cooling or heat transfer means.
- 90** This subclass is indented under subclass 89. Apparatus with means positioning, directing or holding an exchanging fluid against the exterior of the tank or cylinder.
- 91** This subclass is indented under subclass 90. Apparatus with a blade device extending along a surface of the tank cylinder and traversed by the surface during its movement.
- 92** This subclass is indented under subclass 86. Apparatus in which the movable heat exchange surface passes through a body of fluent material to give movement to parts of the body relative to other parts of the body or its container.
- SEE OR SEARCH CLASS:
- 366, Agitating, subclass 147 for heat exchange medium in stirrer of agitator.
- 93** This subclass is indented under subclass 92. Apparatus in which the movable attenuated surfaces sweep across the vertically spaced shelves moving material therealong and into shelf openings.
- 94** This subclass is indented under the class definition. Apparatus wherein a member moves along and in close proximity to surface of a heat exchanger to mechanically dislodge from the surface material undergoing heat exchange.

SEE OR SEARCH CLASS:

- 62, Refrigeration, subclasses 342+ for a congealed product producing means with means for working the congealed material, and subclass 354 for a congealed product producing means with a moving scraper.
- 159, Concentrating Evaporators, subclass 33 for an open pan type concentrating evaporator with a rake means.

- 95** This subclass is indented under the class definition. Apparatus having means for cleaning or facilitating the cleaning of a part of the heat exchange apparatus.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 5, for a regenerative type of heat exchanger with cleaning means.
- 71, for a heat exchanger with a drainage cock or plug.
- 84, for a heat exchanger with means flexing or jarring a heat exchange surface.

SEE OR SEARCH CLASS:

- 15, Brushing, Scrubbing, and General Cleaning, subclasses 301+ for installed cleaners involving no modification of the heat exchanger and subclasses 104.03+ for pipe and tube cleaning implements.
- 62, Refrigeration, subclass 303 for refrigerating apparatus with cleaning means.
- 122, Liquid Heaters and Vaporizers, subclasses 379+ for a closed liquid heater or vaporizer with cleaning means.
- 134, Cleaning and Liquid Contact With Solids, appropriate subclasses for cleaning apparatus of more general utility.
- 137, Fluid Handling, subclasses 237+ for a fluid handling system not specialized to heat exchange with cleaning means.
- 451, Abrading, for an abradant type of scouring device.

- 96** This subclass is indented under the class definition. Apparatus including a movable means for adjusting the rate or direction of flow of

heat, or of heat exchanging fluid, or for starting or stopping such flow.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 200+, for a device in which the adjustment is automatic.

SEE OR SEARCH CLASS:

- 62, Refrigeration, subclass 383 for a refrigerating system with a movable thermal means varying heat transmission.

- 97** This subclass is indented under subclass 96. Apparatus in which the movable controller selects the direction of fluid flow through a temperature modifying section of the heat exchanger.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 4, for a regenerative type heat exchanger having a heat storage mass through which flow is periodically crossed or reversed.

SEE OR SEARCH CLASS:

- 62, Refrigeration, subclasses 324.1+ for a refrigerating system in which the flow of refrigerant may be reversed or crossed and subclass 325 for a system in which the flow of external fluid may be reversed or crossed.
- 137, Fluid Handling, subclass 309 for a reversing valve of the regenerative furnace type, per se.

- 98** This subclass is indented under subclass 96. Apparatus in which the adjustable flow controlling means is positioned adjacent to and controls flow through a radiator face.

- 99** This subclass is indented under subclass 98. Apparatus in which the adjustable means is located at the discharge of the radiator.

SEE OR SEARCH CLASS:

- 454, Ventilation, subclasses 284+ for a register controlling the discharge of air from a duct or housing.

- 100** This subclass is indented under subclass 96. Apparatus in which the movable controller apportions or stops flow in verging flow paths.

SEE OR SEARCH THIS CLASS, SUBCLASS:

282+, 294 and 296+, for the automatic control of branched flow of heat exchanging fluid.

- 101** This subclass is indented under subclass 100. Apparatus in which the flow adjuster controls the flow through parallel commonly supplied paths each of which has a temperature modifying section.

- 102** This subclass is indented under subclass 100. Apparatus in which the movable device controls flow between a tortuous flow path and a direct flow path formed by baffles within a fluid conducting, heating or cooling vessel.

- 103** This subclass is indented under subclass 100. Apparatus in which the movable controller adjusts flow between a heating or cooling branch and another branch in common with the heating or cooling branch.

104.11 INTERMEDIATE FLUENT HEAT EXCHANGE MATERIAL RECEIVING AND DISCHARGING HEAT:

This subclass is indented under the class definition. Apparatus in which a retained body of material forming part of the apparatus acts as a heat storage or carrier means for the apparatus and flows from an area where heat is added to an area where heat is removed.

- (1) Note. The flowing material of this and the indented subclasses may serve to retain heat and transport that heat to another location.
- (2) Note. A heat carrier means is continuous in operation so that at any time a given amount of heat is added and an equal amount of heat is removed. A heat storage means is intermittent in operation so that heat may be added at a different rate than it is removed.

- (3) Note. Application of heat to one location of a stationary mass of fluid will effect flow of the fluid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 4+, for heating a retained solid mass to the liquid state without flow thereof; and for heat transfer to solid material that is caused to move nonfluently.
- 236, for automatic control of heat storage in a heating and cooling system.

SEE OR SEARCH CLASS:

- 62, Refrigeration, subclasses 430+ for refrigerating apparatus including an intermediate fluid container transferring heat to a heat absorber or hold-over.
- 126, Stoves and Furnaces, for a heat source combined with means to retain a body of flowable material to distribute the heat to another location.
- 201, Distillation: Processes, Thermolytic, subclasses 10+ for a process in which hot fluent material, part of the apparatus, is used to carbonize carbonaceous material.
- 252, Compositions, subclasses 67+ for a composition to be used as a heat transfer agent.

104.12 Reversible chemical reaction:

This subclass is indented under subclass 104.11. Apparatus wherein heat is applied to the retained body of material to effect electron exchange or sharing and heat is removed from the retained body of material to effect reverse electron exchange or sharing, so that the retained body of material returns to its original condition.

- (1) Note. Included herein is apparatus utilizing chemical bonding as in adsorption and desorption if they are endothermic and exothermic reactions.

104.13 Plural intermediate fluent heat exchange materials:

This subclass is indented under subclass 104.11. Apparatus wherein a first and a second retained body of material, each forming part of the apparatus, act as heat storage or carrier

means for the apparatus and each flow from an area where heat is added to an area where heat is removed.

- (1) Note. Apparatus including a retained body of Freon and a retained body of oil, even if in direct contact, is not included in this subclass unless there is a specific disclosure that the purpose of each material is to act as a heat storage means. The normal purpose of the oil in such a mixture is to lubricate the moving parts of the apparatus.
- (2) Note. Each retained body of material must be of the type found in subclass 104.11.

104.14 Always out of direct contact with each other:

This subclass is indented under subclass 104.13. Apparatus wherein the apparatus is compartmentized to prevent engagement of the retained bodies of material with each other.

104.15 Solid fluent heat exchange material:

This subclass is indented under subclass 104.11. Apparatus wherein the retained body of material which acts to receive and discharge heat exists, at least during part of the normal operation of the apparatus, in the solid state.

- (1) Note. The solid heat exchange material of this subclass may be pelletized or particulated so that flow takes place. For placement herein, it is required that there be flow of the material, not just movement. For example, included herein is an apparatus having a conveyor that dumps the heat exchange material thereby allowing it to flow, whereas an apparatus that carries similar material continuously is excluded since at no time is the material allowed to flow.
- (2) Note. The retained body of material may be fluent when in the liquid state and may be nonfluent when in the solid state but must be solid at least during part of the normal operation of the apparatus.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 4+, for heat transfer to solid material that is caused to move under continuous control of the apparatus.
- 104.19, for a retained body of material which is solid when not in use but liquid during the normal operation of the apparatus.

104.16 Fluidized bed:

This subclass is indented under subclass 104.15. Apparatus wherein the retained body of material is supported against gravity by a flow of liquid or gaseous material passing therethrough such that the retained body of material is rendered fluent and is confined in a pool like area.

104.17 Utilizing change of state:

This subclass is indented under subclass 104.15. Apparatus wherein the heat of fusion or the heat of vaporization of the retained body of material is intentionally used to assist in heat storage or in heat transportation.

104.18 Including means to move heat exchange material:

This subclass is indented under subclass 104.15. Apparatus including structure to force the retained body of material to move from one area to another.

- (1) Note. Structure utilizing gravity or capillary attraction is not considered to be provided with means to move the retained body of material.

104.19 Liquid fluent heat exchange material:

This subclass is indented under subclass 104.11. Apparatus wherein the retained body of material which acts to receive and discharge heat exists, at least during some part of the normal operation of the apparatus, in the liquid state.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 104.15, for apparatus which functions with the retained body of material in the liquid state and at other times in the solid state during the normal operation of the apparatus.

104.21 Utilizing change of state:

This subclass is indented under subclass 104.19. Apparatus wherein the heat of vaporization of the retained body is intentionally used to assist in heat storage or in heat transportation.

104.22 Including means to move heat exchange material in liquid state:

This subclass is indented under subclass 104.21. Apparatus provided with means to act to force the retained body of material, while in liquid state, to flow.

- (1) Note. Structure utilizing gravity, steady-state centrifugal force, or capillary attraction is not considered to be provided with means to move the retained body of material. Structure generating centrifugal force to cause material to flow is included herein.
- (2) Note. A thermosiphon for causing the material to flow is considered to be a means for moving heat exchange material.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 104.21, for similar apparatus wherein liquid heat exchange material moves by the effect of gravity.
- 104.26, for similar apparatus wherein liquid heat exchange material moves by capillary attraction.
- 104.28, for similar apparatus wherein the liquid heat exchange material does not change state during operation of the apparatus.

104.23 By direct application of electrical energy to heat exchange material:

This subclass is indented under subclass 104.22. Apparatus wherein the retained body of material is of such composition that it can be manipulated by electrical energy applied thereto, and wherein the forcing means acts by applying such energy to the retained body of material in the liquid state.

104.24 By application of heat other than in heat receiving area:

This subclass is indented under subclass 104.22. Apparatus wherein the retained body of material is caused to flow by means serving to apply thermal energy thereto for the specific purpose of causing the material to flow, which thermal energy is applied at a location of the apparatus remote from the locations at which heat is added or removed.

- (1) Note. While heat is added to the heat exchange material by the apparatus of this subclass causing the material to move, the quantity is generally insignificant, rather the heat is applied for the recited purpose of causing the material to move rather than to raise the temperature thereof.

104.25 By application of mechanical energy:

This subclass is indented under subclass 104.22. Apparatus including means to engage the material of the retained body and transfer that material to effect its flow.

104.26 Utilizing capillary attraction:

This subclass is indented under subclass 104.21. Apparatus including a tubelike passage for flow of the retained body of material while in the liquid state, wherein the passage-way is sufficiently small such that the surface tension of the material serves to influence the flow of material passing therethrough.

- (1) Note. The capillary flow of this subclass is deemed to be inherent in the design of the structure, as in the case of provision for gravity flow, and the capillary tube is not therefore considered to be means to move the retained liquid material.
- (2) Note. A "heat pipe" with a capillary passageway or wicking material therein is considered to involve a change of state.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 104.22, for similar structure wherein flow of the retained material is caused by mechanical means in engagement therewith.

104.27 With pressurizing means or degassifying means:

This subclass is indented under subclass 104.21. Apparatus combined with means to alter the ambient pressure acting on the retained body of material or combined with means to separate or release vaporous material from the retained body of material.

104.28 Including means to move heat exchange material:

This subclass is indented under subclass 104.19. Apparatus provided with means to act to force the retained body of material to flow.

- (1) Note. Structure utilizing gravity or capillary attraction is not considered to be provided with means to move the retained body of material.
- (2) Note. A thermosiphon for causing the material to flow is considered to be a means for moving heat exchange material.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 104.21, for similar apparatus wherein liquid heat exchange material moves by the effect of gravity.
- 104.22, for similar apparatus wherein liquid heat exchange material is moved, which material changes state during operation of the apparatus.
- 104.26, for similar apparatus wherein liquid heat exchange material moves by capillary attraction.

104.29 Utilizing formed bubble:

This subclass is indented under subclass 104.28. Apparatus wherein vapor lighter than other portions of the material rises through the apparatus to carry liquid material along.

104.31 By application of mechanical energy:

This subclass is indented under subclass 104.28. Apparatus including means to engage the material of the retained body and transfer that material to effect its flow.

104.32 With pressurizing means or degassifying means:

This subclass is indented under subclass 104.19. Apparatus combined with means to alter the ambient pressure acting on the retained body of material or combined with means to separate or release vaporous material from the retained body of material.

- (1) Note. Means to force the retained body of material to flow is not considered to alter the environmental pressure acting on the retained body under the definition of this subclass.

104.33 Cooling electrical device:

This subclass is indented under subclass 104.19. Apparatus particularly adapted to removing heat from a member, which member has been previously heated by resistance to electricity passing therethrough.

104.34 Including means to move gaseous heat exchange material:

This subclass is indented under subclass 104.11. Apparatus with means to act to force the retained body of gaseous or vaporous material to flow.

- 108** This subclass is indented under the class definition. Apparatus including means providing for flow of exchange fluid in a delineated path from the discharge of a heat exchange zone back to the inlet of the zone.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 104.11, for an intermediate retained fluent material forming a part of the apparatus recycling in a flow path to transfer heat receiving zone.

SEE OR SEARCH CLASS:

- 62, Refrigeration, subclass 376 for refrigerating apparatus with liquid contacting a discrete commodity with means for recirculating the liquid.
- 122, Liquid Heaters and Vaporizers, subclasses 406+ for a closed liquid heater with circulation means.
- 126, Stoves and Furnaces, subclass 387.1 for an open-top liquid heating vessel that may include a lid having an agita-

tor or circulator using the heated liquid within the vessel.

109.1 WITH AGITATING OR STIRRING STRUCTURE:

This subclass is indented under the class definition. Apparatus including means for imparting movement to parts of a body of exchange material within a heat exchange structure.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 84, for means flexing, jarring or vibrating a heat exchange surface.
- 85, for an agitator or impeller having a motor operated by exchange fluid.
- 87, for a hollow, heating or cooling screw type impeller.
- 88, for a rotor with separate chambers for two exchanging fluent materials; e.g., cooled tumbling drum.
- 92, for a heat exchanger having stirrer or scraper with an internal passage for a heating or cooling fluid.
- 94, for a heat exchanger with a scraper removing product from a heat exchange surface.

SEE OR SEARCH CLASS:

- 62, Refrigeration, subclasses 342+ for refrigerating means producing a congealed or modified product with means for working the congealed or modified product, and subclass 392 for a refrigerated liquid dispenser with an agitator for the withdrawable liquid.

- 110** This subclass is indented under the class definition. Apparatus having structure within a flow path establishing or maintaining a body or stream of a fluid of one density in communication with a fluid of a second density.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 60, for a heating and cooling system including a gas-liquid contact device.
- 226, for the automatic control of a gas and liquid contact device in a heating and cooling system.

SEE OR SEARCH CLASS:

- 62, Refrigeration, subclasses 272+ for a heat absorber with means handling water condensed from the air, and subclasses 304+ for means specialized to cooling including a gas liquid contact device.
- 122, Liquid Heaters and Vaporizers, subclass 34 for an indirectly heated liquid vaporizer having an internal vapor separator; subclasses 488 to 492 for a closed liquid vaporizer with a vapor-liquid separator; and subclass 508 for a steam dome for a liquid vaporizer.
- 126, Stoves and Furnaces, subclass 113 for a hot air furnace having an air moistener or subclass 389.1 for an open-top liquid heating vessel that may include a lid having a vent for steam emitted from the liquid that may be a passage-way to a stove hole in a stove top.
- 137, Fluid Handling, subclasses 154+ for diverse fluid containing systems not specific to heat exchange.
- 210, Liquid Purification or Separation, subclasses 157+ for a liquid separator with an ancillary heat exchanger.
- 237, Heating Systems, subclass 78 for a heating system radiator having an air moistener.

- 111** This subclass is indented under subclass 110. Apparatus in which a chamber or flow passage in which the two fluids communicate, has a separate discharge port for separate withdrawal of each of the fluids.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 58+, for a combined heating and cooling system with an ancillary gas separator.
- 71, for a heat exchanger with a purge, or drainage, cock or plug.

SEE OR SEARCH CLASS:

- 62, Refrigeration, subclasses 36+ for means for producing a liquefied gas product from a gas and subclass 475 for a refrigerant producer having an element separately discharging refrigerant and a separate impurity.

- 96, Gas Separation: Apparatus, for apparatus for gas separation of the type provided for in Class 96 combined with a heat exchanger.
- 159, Concentrating Evaporators, appropriate subclasses for a concentrating evaporator.
- 196, Mineral Oils: Apparatus, appropriate subclasses for mineral oil separating apparatus.
- 202, Distillation: Apparatus, subclasses 163+ for the volatilization and condensation of a liquid to be recovered from a mixture, especially subclasses 185+ for a condenser combined with a still; and subclasses 239+ for an element specialized to distillation.
- 210, Liquid Purification or Separation, subclass 180 for a heated liquid separator with vapor or gas removal means.
- 112** This subclass is indented under subclass 111. Apparatus in which there is a means for changing the temperature or pressure of one of the fluids separated by the withdrawal.
- 113** This subclass is indented under subclass 112. Apparatus in which the fluid modification is effected by a heated or cooled surface forming a part of the apparatus.
- 114** This subclass is indented under subclass 111. Apparatus having a flow directing means adjacent the outlet for a less dense fluid, directing such fluid into its outlet or directing a heavier fluid away from the outlet.
- 115** This subclass is indented under subclass 110. Apparatus including means for establishing a liquid layer, which layer flows by gravity along a surface confining it or drops from one surface to another, said surface of a separate temperature modifying means closely adjacent thereto serving to heat or cool the liquid.
- SEE OR SEARCH CLASS:
- 122, Liquid Heaters and Vaporizers, subclass 39 for a closed liquid vaporizer of the film type.
- 159, Concentrating Evaporators, subclasses 13+ for a concentrating evaporator of the moving film type.
- 261, Gas and Liquid Contact Apparatus, subclass 153 for a gas liquid contact device having a gas exposed liquid body or sheet contacting a heat exchanger and having means promoting the contact of gas with the liquid.
- 116** This subclass is indented under subclass 115. Apparatus comprising vertically spaced shelves in a liquid flow path.
- SEE OR SEARCH CLASS:
- 261, Gas and Liquid Contact Apparatus, subclass 148 for a heated or cooled absorption or rectification column.
- 117** This subclass is indented under subclass 115. Apparatus comprising vertically spaced horizontally extending exchange fluid conducting pipe sections with means distributing liquid along the exterior of an upper pipe section for flow thereover onto the exterior of a lower pipe section.
- 118** This subclass is indented under subclass 115. Apparatus in which the heated or cooled surface is a section of a figure of revolution having a vertical axis.
- 119** This subclass is indented under the class definition. Apparatus including apparatus for separating solid materials from a heat exchanging fluid.
- SEE OR SEARCH CLASS:
- 62, Refrigeration, subclasses 317+ for refrigerating apparatus with a separator-clarifier for the cooled fluid or ice melt.
- 96, Gas Separation: Apparatus, for apparatus for gas separation of the type provided for in Class 96 combined with a heat exchanger.
- 210, Liquid Purification or Separation, subclasses 153+ for a structurally installed liquid separator wherein there is included only enough heat exchange structure to associate it with the filter and subclasses 175+ for a liquid separator with an ancillary heater or heat exchanger.

120 This subclass is indented under the class definition. Apparatus having a kinetic energy device acting on the material being treated to move or carry it within or through the apparatus.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 44, for a device in which the motion of a vehicle causes fluid to move over an attenuator.
- 85, for a heat exchanger in which an agitator or impeller motor is operated by exchange fluid.
- 86+, for a device in which movement of material relative to an attenuated surface is produced by movement of the attenuator.
- 94, for a heat exchanger with a scraper removing product from a heat exchange surface.
- 107, for a heat exchanger having a mechanical impeller pumping an intermediate fluid between a heat receiving and a heat rejecting zone.
- 108, for a heat exchanger with recirculation means.
- 109, for a heat exchanger with agitating or stirring structure.

SEE OR SEARCH CLASS:

- 34, Drying and Gas or Vapor Contact With Solids, appropriate subclasses for a drier with material handling and heating structure.
- 99, Foods and Beverages: Apparatus, subclasses 360+ for a filled receptacle type of food cooker with a conveyor; subclass 420 for a spit or impaling type of food cooker with a conveyor and subclass 443 for a food cooker with a conveyor; for apparatus that uses kinetic energy to aid in separating one portion of food from another, search subclasses 518+, 571, 586, and 623+.
- 134, Cleaning and Liquid Contact With Solids, appropriate subclasses, for means handling a solid material in contact with a liquid not specific to heat exchange.
- 137, Fluid Handling, subclasses 334+ for a fluid handling system with heating or cooling of the system.

- 221, Article Dispensing, subclass 150 for an article dispenser with heating or cooling means.
- 222, Dispensing, subclass 146 for a fluid dispenser with heating or cooling means.
- 312, Supports: Cabinet Structure, subclass 36 for a cabinet with a magazine type article discharge device having cooling means.
- 432, Heating, subclasses 121+, for a residual material heating chamber with heating structure having means by which the work is progressed or moved mechanically and subclass 230, for a residual heat emitter and means moving or guiding work relative to the heat emitter.

121 This subclass is indented under subclass 120. Apparatus wherein a motor driven means, e.g., a fan, moves a gaseous fluid across or through a temperature modifier.

SEE OR SEARCH CLASS:

- 62, Refrigeration, subclasses 426+ for a refrigerating device with means forcing air across or through an evaporator and subclasses 467+ for a refrigerant compressor and its connected condenser specialized for use as a subcombination of a refrigeration producer.
- 126, Stoves and Furnaces, subclass 110 for a pump moving air through a hot air furnace.

122 This subclass is indented under subclass 121. Apparatus wherein a housing surrounds both the temperature modifying means and the gas pump.

123 This subclass is indented under subclass 122. Apparatus wherein the stream from the gas pump passes through a device having a restricted outlet opening for increasing the velocity of the stream.

124 This subclass is indented under subclass 122. Apparatus having structure for spreading or dividing an impelled gas stream or uniting another stream therewith.

125 This subclass is indented under subclass 124. Apparatus including a temperature modifier of annular form having radially extending gas passages.

126 This subclass is indented under subclass 124. Apparatus providing a single gas inlet and structure within the housing for dividing the inlet stream into a plurality of distinct streams.

127 This subclass is indented under subclass 126. Apparatus having a gas pump in each outlet stream.

128 This subclass is indented under the class definition. Apparatus in which temperature change caused by the heat exchanger produces flow through a vertically extending passage of the heat exchanger.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 104.21, for recirculation, including thermosyphonic, of an intermediate fluid between a heat source and a heat sink.
- 108, for recirculation, including thermosyphonic, of a heat exchange fluid.
- 120+, for a mechanical or jet means moving a material through a heat exchanger.

SEE OR SEARCH CLASS:

- 137, Fluid Handling, subclass 564 for a distribution system including a thermosyphonic circulating means.
- 237, Heating Systems, subclass 60 for a heating system with water circulation of the vapor-lift pump type.

129 This subclass is indented under subclass 128. Apparatus wherein the flue is a housing that encloses a distinct temperature modifier.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 55, for a wall mounted projecting shield that forms a fluid passage for a temperature modifier.
- 57, for a temperature modifier mounted within a hollow in a wall that is in communication with the room defined by the wall.

SEE OR SEARCH CLASS:

- 237, Heating Systems, subclass 79 for a radiator shield, per se.
- 454, Ventilation, subclasses 43+ for a building flue enclosing a heater.

130 This subclass is indented under subclass 128. Apparatus in which facing structures conducting one fluid form between them a vertically extending flue that produces flow of a second fluid.

131 This subclass is indented under subclass 128. Apparatus in which vertically extending corrugations of a heat transmitting sheet secured to a heating or cooling conduit form flow producing flues.

132 This subclass is indented under the class definition. Apparatus including a tank and tempering means the tank confining a body of fluid which is in constantly open communication with the tempering means, the tank acting as a storage reservoir and the tempering means being ancillary to it.

133 This subclass is indented under the class definition. Apparatus having a member covered by a conforming film of diverse material, having a polished or roughened surface.

SEE OR SEARCH CLASS:

- 106, Compositions: Coating or Plastic, subclass 13 for a fog, frost or ice preventative coating composition; subclass 14.05 for a corrosion inhibiting coating composition; and appropriate subclasses for coating compositions of general application.
- 138, Pipes and Tubular Conduits, subclasses 145+ for a coated pipe not specialized to heat exchange.
- 252, Compositions, subclasses 381+ for a protective coating composition.
- 428, Stock Material or Miscellaneous Articles, subclass 152 and 155 for a stock material product in the form of a single or plural layer web or sheet having a component which is wrinkled, cracked, crazed or slit, and subclasses 409+ for such a product having a particular surface characteristic.

134.1 WITH PROTECTOR OR PROTECTIVE AGENT:

This subclass is indented under the class definition. Apparatus having means to protect it from corrosion, wear, soil or contamination; or to prevent it from receiving or inflicting physical damage.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 55, for a heat exchanger with a shield projecting from a wall.
- 69, for a vibration shield.
- 81+, for protection against damage due to expansion or contraction.
- 129, for a radiator within a convective casing.
- 133, for a heat exchanger with a protective coating.
- 200, for a condition responsive control.

SEE OR SEARCH CLASS:

- 122, Liquid Heaters and Vaporizers, subclasses 504+ for a closed liquid heater with a safety device.
- 123, Internal-Combustion Engines, subclass 142.5 for the combination of an internal combustion engine and means supplying external energy to heat some part or adjunct of the engine such as a radiator.
- 137, Fluid Handling, subclasses 59+ for a freeze condition responsive safety system; subclasses 67+ for a destructible or deformable element control; and subclasses 343+ for a protector for a fluid handling system not specialized to heat exchange.
- 138, Pipes and Tubular Conduits, subclasses 27+ for a freeze protecting pressure compensator and subclasses 32+ for freezing and thawing protection of a tubular conduit not specialized to heat exchange.
- 204, Chemistry, Electrical and Wave Energy, subclasses 196.01+ for electrolytic object protection apparatus.
- 205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclasses 724+ for electrolytic protection of a metal or metal alloy object.

- 237, Heating Systems, subclass 79 for a radiator shield and subclass 80 for a heating system with an antifreeze device.
- 310, Electrical Generator or Motor Structure 310, for apparatus specialized to the protection of an object by the application of a magnetic field.
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 7+ for a method of protecting metal from tarnish or corrosion.
- 432, Heating, subclass 233, for a heating apparatus element having protective cooling structure.

135 This subclass is indented under the class definition. Apparatus having structure provided to inhibit heat or sound transmission.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 69, for a resilient vibration dampener isolating an exchanger element.
- 133, for a heat exchanger having a coating.
- 134, for a heat exchanger with protective means.

136 This subclass is indented under subclass 135. Apparatus comprising a panel having therein insulation and an exchange fluid conducting means.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 46, for a flexible blanket or cover having a passage for an exchange fluid therein.
- 49, for a radiant wall panel used in a heating or cooling system.
- 56, for a constructional installation including a wall having an internal passage for a heating or cooling medium.

SEE OR SEARCH CLASS:

- 52, Static Structures (e.g., Buildings), subclasses 220.1+ for a mere service duct within a building barrier.
- 62, Refrigeration, subclass 451 for a flowing coolant container covered by insulation means or within a hollow wall of a refrigerator and subclass 458

for a refrigerator having an access surface open to the atmosphere.

- 137** This subclass is indented under the class definition. Apparatus including means whereby mode or condition of operation can be changed by shifting or rearranging all or some of the parts in a different relationship to each other, or by addition or omission of a part.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 62, for a system convertible between heating and cooling.
97, for a heat exchanger with means by which fluid flow may be reversed or crossed within a heating or cooling zone.

- 138** This subclass is indented under the class definition. Apparatus combined with a device having a function other than heat exchanging, or serving to perfect the heat exchange apparatus.

- (1) Note. See the search notes to the class definition for other classes having heat exchange means.

- 139** This subclass is indented under the class definition. Apparatus in which (1) fluid from outside a heat exchanger is supplied to a single passage of the heat exchanger through at least two distinct inlets or (2) fluid from a single passage of the heat exchanger is discharged outside of the heat exchanger through at least two distinct outlets.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 100+, for branched flow with a variable controller.
124+, for a mechanical fan and temperature modifier in a housing having verging gas flows.
282+, 294 and 296+, for automatic control of branched flow.

- 140** This subclass is indented under the class definition. Apparatus holding three or more non-communicating fluids in heat exchanging relationship.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 104.11+, for means utilizing a sealed or recycling body of fluent to transfer heat between two other materials.

- 141** This subclass is indented under subclass 140. Apparatus in which at least two of the fluid holders are concentric.

- 142** This subclass is indented under the class definition. Apparatus comprising a structure secured to a container and projecting into the container, said structure comprising a tube, the projecting end of which is closed, and in which fluid is supplied to or removed from the projecting closed end by an interior conduit means running from the secured end to the closed end of the tube.

- 143** This subclass is indented under the class definition. Apparatus including units, each made up of a conduit surrounded by a casing forming a flow passage; said units being connected for flow of one heat exchange fluid through said plural units.

- 144** This subclass is indented under the class definition. Apparatus comprising a plurality of unitary, separate and discrete assemblies connected by distinct flow means; each of said assemblies being (1) a conduit with distinct heat transfer structure, (2) a tube coil, (3) a group of assembled side by side tubes or (4) one casing-conduit unit.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 143, for interconnected plural casing-conduit units.

- 145** This subclass is indented under subclass 144. Apparatus in which the connected units are within the same enclosing structure.

- 146** This subclass is indented under the class definition. Apparatus including structure which provides a progressive amount of heat transfer along a flow path by providing graduated surface areas, or conductivities along the flow path in the direction of flow.

- 147** This subclass is indented under subclass 146. Apparatus in which heat transfer takes place through the wall of a passage increasing progressively in cross-sectional area.
- 148** This subclass is indented under the class definition. Apparatus comprising container structure for line connection to a source of a first exchange fluid, said structure being traversed by a multiplicity of parallel, uniformly distributed passages for a second fluid; said second fluid passages extending through the apparatus and having inlet points in common plane on one side of the container structure and outlet ports in a common plane on the opposite side of the structure.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
128+, for a thermosyphonic flue or convective circulation type of radiator.
- 149** This subclass is indented under subclass 148. Apparatus with means providing a strengthening support or circumferential cover for the fluid confining elements.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
67+, for an external support for a heat exchanger.
- 150** This subclass is indented under subclass 148. Apparatus, in which the container structure comprises serially connected tube sections.
- 151** This subclass is indented under subclass 148. Apparatus, in which the container structure comprises side by side tubes and the traversing passages are formed by distinct heat transmitters traversed by the tubes.
- 152** This subclass is indented under subclass 148. Apparatus in which the traversing passages are formed by a corrugated or deformed sheet or sheets interposed between side by side elements of the container structure.
- 153** This subclass is indented under subclass 152. Apparatus in which the side by side tubes are connected to a common header.
- 154** This subclass is indented under the class definition. Apparatus including structure forming two chambers having a common axis and which do not unite.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
141, for concentric flow chambers in a means providing heat interchange of three noncommunicating fluids.
- SEE OR SEARCH CLASS:
181, Acoustics, subclasses 282+ for a jacket or casing, per se, for a muffler.
220, Receptacles, subclass 592.05, 592.23, 592.24, 495.01+, 23.9, and 23.91 for a metallic receptacle with a spaced wall or jacket not specialized by structure to heat exchange.
- 155** This subclass is indented under subclass 154. Apparatus with means forming a third coaxial chamber communicating with one only of the two chambers that do not unite.
- 156** This subclass is indented under subclass 154. Apparatus with means forming a helical flow path in the outer chamber.
- 157** This subclass is indented under the class definition. Apparatus in which a fluid conducting assembly is arranged inside of, but out of communication with, a housing means; said assembly being (1) a coiled conduit (2) a group of side by side conduits or (3) a conduit with distinct heat transfer structure.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
54, for a conduit assembly installed in a wall traversing passage means.
55, for a conduit assembly within a space formed by a wall and a projecting shield.
57, for a conduit assembly in a wall defined space.
74, for a heat exchanging means mounted on a cover for an access opening and projecting into the covered chamber.
75, for a chamber with an internal attenuator and having a removable cover for an access opening.

- 92, for a vessel or housing in which the conduit assembly serves as a scraper or agitator.
- 108, for recirculation of a heat exchange fluid including thermosyphonic circulation produced by a conduit assembly within a vessel.
- 122+, for a conduit assembly and a gas pump in a common housing.
- 129, for a conduit assembly within a distinct housing forming a thermosyphonic type flue.
- 134, for a heat exchanger with a protector that may be a shield.
- 142, for a spur tube projecting into an enclosure.
- 143, for plural casing-conduit units that are line or common header connected.
- 145, for line connected conduit assemblies in a common casing.
- 154, for noncommunicating coaxial enclosures.
- SEE OR SEARCH CLASS:
- 181, Acoustics, subclasses 282+ for a jacket or casing, per se, for a muffler.
- 158** This subclass is indented under subclass 157. Apparatus in which the conduit assembly comprises a header plate and tubes, said plate forming with a section of the casing a manifold for the tubes.
- 159** This subclass is indented under subclass 157. Apparatus including a distinct flow director in the space between the casing structure and the conduit assembly elements.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 110+, for a heat exchanger in which a flow director forms a first fluid holder or collector open to a second fluid.
- 124+, for a temperature modifier and gas pump within a housing with means producing verging flow.
- 134.1, for a protector that may be a flow directing baffle.
- 160** This subclass is indented under subclass 159. Apparatus in which the flow director extends a substantial distance in the direction of the center line of a casing having a distinct longitudinal axis.
- 161** This subclass is indented under subclass 160. Apparatus including additional flow directing means transversely arranged relative to the longitudinal flow director.
- 162** This subclass is indented under subclass 157. Apparatus having a distinct structure within the space between the conduit assembly elements and the casing holding the assembly in position.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 82, for a heat exchanger with expansion relieving or absorbing means supporting a tube assembly within an exchanger.
- 163** This subclass is indented under subclass 157. Apparatus including a continuous conduit which is coiled, looped or bent within the casing stream.
- 164** This subclass is indented under the class definition. Apparatus in which a stream of one heat exchanging fluid is conducted in indirect heat exchange relationship with a stream of a second fluid.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 140+, for means providing interchange of three or more fluids.
- 154+, for a device in which the exchanging streams are concentric.
- 157+, for a device in which one of the fluid streams is in a casing enclosing the conductor of the second stream.
- 165** This subclass is indented under subclass 164. Apparatus in which plural passages for one fluid are interfitted and intermingled with flow passages for another fluid.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 148+, where the interdigitated passages form a radiator core.
- 166** This subclass is indented under subclass 165. Apparatus in which the interfitted passages are formed between facing sections of a plurality

- of thin members of considerable surface area stacked face to face.
- 167** This subclass is indented under subclass 166. Apparatus in which alternate interface passages of the stack are connected by passage means penetrating or extending through plates of the stack.
- 168** This subclass is indented under the class definition. Apparatus in which an extended surface structure has a fluid conductor conforming to the surface or has a passage formed within it.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 46, for a flexible envelope or cover type of heat exchanger.
 - 49, for a heating and cooling radiant building panel.
 - 56, for a heating or cooling panel making up a part of a building.
 - 89+, for a rotatable drum with a heated or cooled surface.
 - 94, for a heat exchange surface with a scraper.
 - 115+, for a heated or cooled trickler surface.
 - 136, for a heating or cooling conduit and insulation within a barrier or panel.
- SEE OR SEARCH CLASS:
- 126, Stoves and Furnaces, subclass 33 for a steam table.
 - 237, Heating Systems, subclasses 70+ for a heating system radiator.
- 169** This subclass is indented under subclass 168. Apparatus in which the extended surface is a part of an enclosure forming means.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 154+, for noncommunicating coaxial enclosures that may comprise a vessel and its jacket.
- SEE OR SEARCH CLASS:
- 62, Refrigerator, subclasses 516+ for an enclosure forming evaporator.
 - 220, Receptacles, subclass 592.05, 592.23, 592.24, 495.01+, 23.9, and 23.91 for a spaced wall or jacketed receptacle not specialized by structure to heat exchange.
- 170** This subclass is indented under subclass 168. Apparatus in which spaced areas of facing sheet, shell or plate sections form a fluid conducting passage of a panel made up of such sections.
- SEE OR SEARCH CLASS:
- 62, Refrigeration, subclass 523 for a corrugated or embossed wall evaporator.
- 171** This subclass is indented under subclass 168. Apparatus comprising side by side tubes with their interspaces substantially covered by distinct interconnected structure.
- 172** This subclass is indented under the class definition. Apparatus in which two or more lengths or loops of tubing or two or more tubular elements are assembled alongside each other.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 117, for a trickler in which liquid flows across parallel horizontal pipes.
 - 130, for facing conduits forming a thermosyphonic flue.
 - 144+, for distinct conduit assemblies that are line connected.
 - 150, for a radiator of the core type made up of serially connected tube sections.
 - 151, for a radiator of the core type made up of side by side tubes traversing a group of fins.
 - 152+, for a radiator of the core type made up of side by side tubes spaced by deformed passage forming sheets.
 - 157+, for a tube assembly in a casing or tank.
 - 171+, for a panel or wall structure made up of side by side tube elements.
- 173** This subclass is indented under subclass 172. Apparatus in which the tubular elements are interconnected by structure forming a part of a communicating manifold chamber in which fluid flow verges.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 153, for a tube manifold connecting side by side tubes in a core type radiator.

- 158, for encased tube assembly with a manifold formed by a tube sheet and casing section.
- SEE OR SEARCH CLASS:
- 122, Liquid Heaters and Vaporizers, subclass 512 for a tube sheet specialized for use in a boiler.
- 174** This subclass is indented under subclass 173. Apparatus wherein structure is provided for directing or distributing a fluid within the conduits or header chamber.
- 175** This subclass is indented under subclass 173. Apparatus including an additional manifold, the tubes receiving fluid from one and discharging into the other.
- 176** This subclass is indented under subclass 175. Apparatus wherein the manifolds are located at the same end of the apparatus.
- 177** This subclass is indented under the class definition. Apparatus comprising a hollow body of tubular formation.
- SEE OR SEARCH CLASS:
- 138, Pipes and Tubular Conduits, subclass 38 for a pipe with merely internal baffles designed to facilitate a transfer of heat between fluids inside and outside of the pipe; and appropriate subclasses for a pipe not specialized by structure to heat exchange.
- 178** This subclass is indented under subclass 177. Apparatus with means connecting the hollow body for flow of fluid there-through or for supporting it in a heat exchanger.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 162, for means supporting a conduit assembly in a casing.
- 173+, for side by side tubular structures connected by a manifold type header.
- SEE OR SEARCH CLASS:
- 248, Supports, subclasses 59+ for a pipe support of general application.
- 285, Pipe Joints or Couplings, for a pipe joint or coupling of general application.
- 179** This subclass is indented under subclass 177. Apparatus including external and internal heat transmitters projecting from the body wall.
- 180** This subclass is indented under subclass 177. Apparatus in which the tubular structure includes elements made of different materials.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 133, for a heat exchanger with a coated surface.
- 134.1, for a protector that may be a protective liner.
- SEE OR SEARCH CLASS:
- 138, Pipes and Tubular Conduits, subclasses 140+ for a pipe or tubular conduit of general application having distinct layers.
- 181** This subclass is indented under subclass 177. Apparatus with distinct heat conducting structure for enhancing the transfer of heat.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 151, for a core type radiator formed by side by side tubes traversing fin means.
- 152, for a core type radiator formed by a heat transmitter between two side by side tube means.
- 171, for a heat transmitter spanning side by side tube means and forming a panel.
- SEE OR SEARCH CLASS:
- 123, Internal-Combustion Engines, subclass 41.69 for an internal combustion engine with a finned cylinder or head.
- 313, Electric Lamp and Discharge Devices, for an electric lamp or discharge tube with an attached radiating surface member.
- 182** This subclass is indented under subclass 181. Apparatus having spaced heat transmitting plate sections spaced along the hollow body and distinct structure between the plate sections holding them in position relative to each other.

- 183** This subclass is indented under subclass 181. Apparatus in which the longitudinal axis of the distinct heat conducting structure is disposed in a plane parallel to or forming a sharp angle with the axis of the tubular structure.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

171, for a panel formed by means, e.g., plate, spanning side by side tube elements.

- 184** This subclass is indented under subclass 183. Apparatus in which the distinct heat conducting structure forms a helix about the tubular structure.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

156, for coaxial enclosures with means forming a helical passage in the annular outer enclosure.

- 185** This subclass is indented under the class definition. Elements for receiving heat from one material and conducting it for discharging to another.

- 186** This subclass is indented under the class definition. Apparatus not otherwise classifiable.

200 WITH TIMER, PROGRAMMER, TIME DELAY, OR CONDITION RESPONSIVE:

This subclass is indented under the class definition. Subject matter wherein associated with the heat transfer apparatus there is an instrument having either: (a) a means for measuring or recording time; or a device for controlling the heat transfer apparatus at a predetermined time (e.g., a clock- thermostat, an oven timer, etc.); or (b) a means for scheduling or coordinating the performance of a repetitive sequence of operations; or (c) a means for accepting an input signal and providing a time interval before initiating an output signal; or (4) a means to sense a randomly occurring condition or a change in condition of the heat transfer apparatus, wherein the sensing means operates to directly or indirectly effect a change in an operation of the heat transfer apparatus.

- (1) Note. In many cases, a programmer controls a sequence of operations of a cyclic nature.

SEE OR SEARCH CLASS:

62, Refrigeration, subclasses 157+ for an automatically controlled refrigerating system with a time and program actuator; subclass 171 for control apparatus associated with a gas-liquid contact cooler; subclass 176 for control of a refrigeration system by a humidity sensor; subclasses 231+ for a refrigerating system controlled by a time or program actuator; and appropriate subclasses for processes limited to refrigeration and apparatus having features specialized to refrigeration. Note. The line between Classes 165 and Class 62 is: Class 165 takes: (a) A reversible heat pump or a refrigeration producing system that provides useful cooling, in combination with a supplemental heating means near or on a condenser for providing heat during a heating mode. (b) A refrigeration evaporator or condenser, per se. (c) Nominal recitation of an expansion device in combination with specific evaporator structure. (d) A liquid receiver or an accumulator which is built into or as a part of a heat exchanger. (e) A refrigeration producer having means to convert the same to a heating system so that it no longer function as a refrigeration producer (e.g., by omitting the evaporator, etc.). Class 62 takes: (a) A reversible heat pump or a refrigeration producing system that provides useful cooling. (b) Specific expansion device structure in combination with an evaporator. (c) A reversible heat pump or a refrigeration producing system that provides useful cooling in combination with a heating means for removing or preventing the deposition of condensate (frost) or thawing a freezing mold.

- (1) Note. A reversible heat pump or a refrigeration producing system that provides useful cooling in

- combination with a supplemental heating means at or on the condenser is classified in Class 165. A refrigeration producing system having means to convert the same to a heating system so that at one time it no longer functions as a refrigeration producer (e.g., omitting the evaporator, etc.) is also classified in Class 165.
- 236, Automatic Temperature and Humidity Regulation, subclass 44 for automatic humidity controlling mechanism; subclass 46 for temperature or a humidity controlling mechanism including a timing means; and appropriate subclasses for a temperature or humidity control mechanism associated with general utility. Note. The line between Class 165 and 236 is: Class 165 takes: (a) Nominal recitation of a means for heating and cooling, and a means for automatically controlling the means for heating and cooling. (b) Specific heat exchanger structure in combination with a means for automatically controlling a heat exchanger. (c) Specific heat exchange structure in combination with a means for automatically controlling a heating and a cooling means. Class 236 takes: A patent with nominal recitation of a heat exchanger in combination with a means for automatically controlling a heating or cooling means.
- 237, Heating System, subclasses 70+ for structure of a radiator of a heating system.
- (1) Note. The line between Classes 165 and 237 on reversible heat pump or refrigeration producing system is: Class 165 takes: A reversible heat pump or refrigeration system that provides useful cooling in combination with a supplemental heating means on or near a condenser for providing heat during a heating mode. Class 237 takes: A reversible heat pump or refrigeration producing system that only provides useful heating.
- (2) Note. The line between Classes 165 and 237 on radiator for heating is: Class 165 takes: (a) Radiator structure, per se. (b) Radiator structure in combination with building structure. Class 237 takes: A patent with a heating system for a habitable enclosure (e.g., building structure, etc.) having a radiator in combination with a heat generator (e.g., boiler, steam generator, etc.) or in combination with a means to distribute radiator fluid to different areas of the habitable enclosure (e.g., piping, a plurality of connected radiators, etc.).
- 366, Agitating, appropriate subclasses for agitating process or apparatus of general utility; subclasses 144+ for an agitator in combination with a heating or cooling means.
- (1) Note. The line between Classes 165 and 366 on combined agitator and heat exchanger is: Class 165 takes: (a) All patents with significant heat exchange structure in combination with nominal structural recitation of an agitator. (b) All patents with a heat exchanger having an agitator which operates on a working fluid (e.g., a coolant or heating fluid), whether or not the agitator structure is broadly or significantly claimed. (c) All patents with a heat exchanger having a working fluid (e.g., a coolant or heating fluid) which goes through the inside of a movable portion of an agitator, whether or not the agitator structure is broadly or significantly claimed. Exception to the above statements (b) and (c): Patents in which a working fluid is agitated by an agitator and then allowed to be mixed in a mixing chamber containing a material or fluid to be treated (heated or cooled) are classified in Class 366. Class 366 takes: (a) Significant agitator structure in combination with significant structure of a heat

exchanger. (b) Significant agitator structure in combination with nominal structure of a heat exchanger. Exception to the above statements (a) and (b): A patent with a heat exchanger having a working fluid (a coolant or heating fluid) which goes through the inside of a movable portion of an agitator is classified in Class 165, whether the agitator structure is significantly or broadly claimed. Class 366 takes a heat exchanger having an agitator which operates on a working fluid only if the working fluid is then allowed to flow into a mixing chamber containing a material or fluid to be heated or cooled.

- 454, Ventilation, appropriate subclasses for ventilation means and related processes not including specific heat exchange means.

201 Having heating and cooling capability:

This subclass is indented under subclass 200. Subject matter including a heating and cooling system capable of providing heating and cooling to an area at the same time or at different times.

SEE OR SEARCH CLASS:

- 62, Refrigeration, subclasses 80+ for system with defrosting or frost inhibiting; and subclass 90 for refrigeration system with reheating.
- 99, Foods and Beverages: Apparatus, subclass 468, 486+ for apparatus with automatic control or time means; subclass 470 for apparatus with sequential heating and cooling; and subclass 483 for apparatus having noncooking heat treatment of food.
- 236, Automatic Temperature and Humidity Regulation, subclass 1 for control of heating and cooling; subclass 91 for thermostatic control of hot and cold; and appropriate subclasses for automatic temperature and humidity control mechanisms.
- 324, Electricity: Measuring and Testing, subclass 760 for measuring and testing device with temperature control.

- 373, Industrial Electric Heating Furnaces, subclass 113 for resistance furnace devices for cooling.
- 374, Thermal Measuring and Testing, subclass 45 for thermal testing of a non-thermal quantity.
- 432, Heating, appropriate subclasses for a residual material heating apparatus or method.

202 Vehicle installation:

This subclass is indented under subclass 201. Subject matter wherein the heating and cooling system is mounted in a vehicle capable of transporting an occupant.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 41, 42-43, for heat exchange apparatus combined with vehicle feature.

SEE OR SEARCH CLASS:

- 62, Refrigeration, subclass 239, 243, 244 for refrigeration system combined with vehicle feature.
- 219, Electric Heating, subclasses 202+ for heating devices combined with vehicle component.
- 237, Heating Systems, subclasses 12.3+ for heating system of vehicle.
- 454, Ventilation, subclass 75 for vehicle ventilation system having automatic control means; subclasses 69+ for vehicle ventilation system; and appropriate subclasses for particular structure of ventilation system.

203 Plural temperature regulators for plural zones:

This subclass is indented under subclass 202. Subject matter wherein the vehicle has a plurality of distinct areas which are heated or cooled; and wherein each of the distinct areas has its own temperature sensor and temperature setter.

204 Flow control of chest, foot, or defrost air in vehicle:

This subclass is indented under subclass 202. Subject matter including means to regulate the amount of air discharged into the vehicle through a port located at either a chest level of an occupant, near a foot area of an occupant or adjacent to a windshield of the vehicle.

205 Plural temperature regulators for plural zones:

This subclass is indented under subclass 201. Subject matter including a plurality of distinct areas which are heated or cooled, wherein each area has its own area control means comprising a temperature sensor and a temperature setter.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 1 for zone control for heating and cooling medium; subclass 49.3 for electrically actuated ventilator; and subclass 49.4 for pneumatically actuated ventilator.

206 Nonbuilding system (e.g., machine tool, chemical analyzer, etc.):

This subclass is indented under subclass 205. Subject matter wherein said plurality of distinct areas are associated with structure other than a habitable enclosure.

SEE OR SEARCH CLASS:

392, Electric Resistance Heating Devices, subclass 482, 486, 490 for special features of electric resistance heating devices.
422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclass 305 for fume generators, appropriate subclasses for processes or apparatus for treating material.
425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclasses 143+ for plastic or earthenware shaping or treating apparatus having temperature control means.
432, Heating, subclass 18 for heating process wherein work is subjected to diverse treatment or graduated temperatures; subclasses 43+ for heating devices having condition responsive control.

207 Refrigeration system having an evaporator or condenser in each zone:

This subclass is indented under subclass 205. Subject matter wherein the heating and cooling system includes a closed-flow system in which a refrigerant is compressed, condensed in a

condenser, and expanded to produce cooling at a low temperature level in an evaporator; and wherein each of said distinct areas has its own individual evaporator or its own individual condenser.

SEE OR SEARCH CLASS:

62, Refrigeration, subclass 175 for diverse, cascade or compound refrigeration producing system; subclasses 198 through 200 for refrigeration producer having serially arranged evaporator; subclasses 203 through 206 for plural refrigerating producing elements; and appropriate subclasses for processes limited to refrigeration and apparatus having features specialized to refrigeration.

208 Central system prioritizes heating and cooling requests from zones:

This subclass is indented under subclass 205. Subject matter including a common supply source capable of supplying heated or cooled air to each of said distinct areas; the area control means of each of said distinct areas each supplying a control signal to said common supply source; and wherein said common supply source includes signal accepting means to analyze the signals from the distinct areas to decide which of the areas will be first heated or cooled.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 1 for zone control for heating and cooling medium; subclass 49.3 for electrically actuated ventilator; and subclass 49.4 for pneumatically actuated ventilator; subclass 51 for distance-adjusted control devices.

209 Supervisory central control means overrides zone controller:

This subclass is indented under subclass 205. Subject matter including a master control means capable of overruling the operation of at least two of the area control means.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 1 for zone control for heating and cooling medium;

subclass 47 for high and low temperature alternate control devices; subclass 51 for distance-adjusted control devices.

210 Heat balancing using waste heat or cold (e.g., heat reclaim, etc.):

This subclass is indented under subclass 205. Subject matter wherein the heating and cooling system includes a means for utilizing excess heat or cold discharged at one location (e.g., radiation heat from light fixture, etc.) to reduce a heating or cooling requirement in another location (e.g., waste heat can be used to offset heating requirements in space heating, service water heating, air reheat in air conditioning systems, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

54, for heat exchange apparatus combined with wall, floor, or ceiling structure of a chamber; subclass 909 for regeneration heat exchange apparatus.

SEE OR SEARCH CLASS:

62, Refrigeration, subclass 95 for refrigeration process having plural cooling steps; digest 22 for refrigeration system having free cooling.
454, Ventilation, subclass 294 for ventilation system having air passes over lamp; subclass 295 for ventilation system having ceiling type inlet airway and adjustable valve.

211 Different conditioning means for perimeter zone and core zone:

This subclass is indented under subclass 205. Subject matter wherein one of said distinct areas comprises an inner area; another of said distinct areas comprises a boundary area completely surrounding said inner area; and wherein said inner area has one kind of heating or cooling structure (e.g., central system supply, etc.), and the boundary area has a diverse kind of heating or cooling structure (e.g., fan-coil unit under window, etc.).

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 1 for zone control for heating and cooling medium; subclass 49.3 for electrically actuated

ventilator; and subclass 49.4 for pneumatically actuated ventilator.

212 Central temperature conditioned air supplied to each zone:

This subclass is indented under subclass 205. Subject matter including a common air supply source capable of supplying heated or cooled air from the heating and cooling system to each of said distinct areas.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 1 for zone control for heating and cooling medium; subclass 49.3 for electrically actuated ventilator; and subclass 49.4 for pneumatically actuated ventilator.

213 Mixing within zone of recirculated zone air and supply air adjacent zone inlet(e.g., induction unit, etc.):

This subclass is indented under subclass 212. Subject matter wherein an air inlet discharges heated or cooled supply air from the common air supply source to said distinct area; and further including means transporting used air from a location within the distinct area to a location at or near the air inlet for mixing the used air with the supply air.

SEE OR SEARCH THIS CLASS, SUBCLASS:

123, for heat exchange apparatus with injector-type gas pump.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 13 for control devices associated with plenum-type system having mixing fluid of dissimilar temperature.
454, Ventilation, subclasses 228 through 236 for ventilation system having forced recirculation; subclasses 261 through 269 for ventilation system having structure for mixing plural air streams together.

214 Including a fan (e.g., fancoil unit, etc.):

This subclass is indented under subclass 213. Subject matter wherein the transporting means includes a fan.

SEE OR SEARCH CLASS:

454, Ventilation, subclasses 228 through 236 for ventilation system having forced recirculation; subclass 269 for ventilation system having mixed plural air streams and an air pump.

215 Reheat adjacent zone air inlet:

This subclass is indented under subclass 212. Subject matter including a heating means located at or near an air discharge opening (e.g., grill, deflector, etc.) from the supply source to one of said distinct areas; said heating means functioning to heat air from said common air supply source before being discharged into said distinct area.

SEE OR SEARCH THIS CLASS, SUBCLASS:

50, for room heat exchangers with central fluid supply; subclass 228 for a heating and cooling system having means to reheat cooled air down stream of an indirect contact cooling means; subclasses 263 + for a heating and cooling system having opposed and compensating heating and cooling means.

SEE OR SEARCH CLASS:

62, Refrigeration, subclass 90 and 173 for refrigeration system with reheating; subclasses 428+ for refrigeration system having means for directing gas over heat rejector.

216 Mixing of separate centrally supplied hot and cold air streams before discharge into each zone (e.g., dual duct, etc.):

This subclass is indented under subclass 212. Subject matter including a means for separately directing heated or cooled air from said common supply air source toward said distinct areas; and further including means to mix said separately directed heated air with said separately directed cool air before being discharged into said distinct areas.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 1 for zone control for heating and cooling medium; subclass 1 for heating and cooling

control devices; subclasses 12.1+ for control devices associated with structure having mixing fluid of dissimilar temperature; subclass 13 for control devices associated with a plenum-type structure having mixing fluid of dissimilar temperature; subclass 49.3 for electrically actuated ventilator; and subclass 49.4 for pneumatically actuated ventilator.

454, Ventilation, subclasses 261 through 269 for ventilation system having structure for mixing plural air streams.

217 Volume flow of discharged air at discharge into zone modulated by zone heating or cooling load (e.g., variable air volume, etc.):

This subclass is indented under subclass 212. Subject matter wherein a volume of air from the common supply air source discharged into one of said distinct areas is controlled by a means which regulates air flow responsive to the difference between a set point temperature and a measured temperature of the distinct area.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 1 for zone control for heating and cooling medium; subclass 1 for heating and cooling control devices; subclass 49.3 for electrically actuated ventilator; and subclass 49.4 for pneumatically actuated ventilator.

218 Central temperature condition liquid supplied to each zone:

This subclass is indented under subclass 205. Subject matter including a common liquid supply source capable of supplying heated or cooled liquid to each of said distinct areas.

SEE OR SEARCH CLASS:

62, Refrigeration, subclass 185 for control of indirect heat transfer liquid; subclass 201 for control of refrigeration producer by external cooled liquid or holdover; subclass 434 for refrigeration system having an intermediate fluid container and a flow line connected transfer fluid supply and heat exchanger; and subclass 435

- for refrigeration system having an intermediate fluid container and an indirect fluid pump or agitator.
- 236, Automatic Temperature and Humidity Regulation, subclasses 34+ and 36+ for control of cooling or heating radiators.
- 237, Heating Systems, subclass 2 for heating systems with automatic controls; subclasses 59+ for water circulation of heating system; and appropriate subclasses for a heat producer combined with means for distributing a fluid heated thereby, or for apparatus including systems for heating a room, chamber, house, or other inclosing structure when such apparatus is not equally adapted for cooking.
- 219 Separate supply and return mains (e.g., two pipe system, etc.):**
This subclass is indented under subclass 218. Subject matter including a first distinct supply conduit extending between the common liquid supply source and a heat exchanger in a distinct area for supplying liquid to the heat exchanger; and further including a first distinct return conduit extending from the heat exchanger to the common liquid supply source for returning liquid to the common supply source.
- 220 Additional supply main (e. g., three pipe system, etc.):**
This subclass is indented under subclass 219. Subject matter further including a second distinct supply conduit extending between the common liquid supply source and the heat exchanger.
- 221 Additional return main (e.g., four pipe system, etc.):**
This subclass is indented under subclass 220. Subject matter further including a second distinct return conduit extending from the heat exchanger to the common liquid supply source.
- 222 Humidity control:**
This subclass is indented under subclass 201. Subject matter further including means to control atmospheric water vapor content in the area.
- SEE OR SEARCH CLASS:
- 34, Drying and Gas or Vapor Contact With Solids, subclass 50 for drying apparatus with a humidity controller for the contacting gas.
- 62, Refrigeration, subclasses 176.1+ for refrigeration system with humidity sensor.
- 236, Automatic Temperature and Humidity Regulation, subclasses 44+ for humidity control devices; subclass 91 for thermostatic control of hot and cold with humidity sensor.
- 223 Humidity sensor measures humidity of air in conditioned space:**
This subclass is indented under subclass 222. Subject matter including a first sensing means to determine the atmospheric water vapor content in the area to be heated or cooled.
- 224 Additional humidity sensor(e.g., located outside of conditioned space, etc.):**
This subclass is indented under subclass 223. Subject matter further including a second sensing means to determine atmospheric water vapor content in the area or in another location.
- 225 Humidity sensor controls indirect-contact cooling means:**
This subclass is indented under subclass 223. Subject matter wherein said sensing means senses a signal to control a humidity adjustor; said humidity adjustor comprising a cooling device in which a conditioning fluid flowing through the cooling device is separated from a fluid flowing over said cooling device by a heat transfer surface.
- 226 Liquid spray onto indirect-contact cooling means:**
This subclass is indented under subclass 225. Subject matter including a means to spray a liquid onto the heat transfer surface of the humidity adjustor.
- SEE OR SEARCH CLASS:
- 236, Automatic Temperature and Humidity Regulation, subclass 44 for control of humidity with evaporator cooling spray.

- 227 Air bypass of indirect-contact cooling means:**
This subclass is indented under subclass 225. Subject matter including a means to direct a portion of the air through an alternative air passage around said humidity adjustor.
- 228 Reheat of cooled air downstream of indirect-contact cooling means:**
This subclass is indented under subclass 225. Subject matter including a means located downstream of the humidity adjustor to heat the air after the air passes through the humidity adjustor.
- SEE OR SEARCH CLASS:
62, Refrigeration, subclass 90 for refrigeration system with reheating; subclass 176.5 for refrigeration system with humidity sensor and control of air heater (e.g., reheat pump, etc.).
- 229 Humidity sensor controls humidifier:**
This subclass is indented under subclass 223. Subject matter wherein the humidity sensor controls a device to add moisture to the atmosphere in the area.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
60, for heating and cooling heat exchange apparatus having gas liquid contactor.
- SEE OR SEARCH CLASS:
62, Refrigeration, subclass 171 for refrigeration system having gas liquid contact cooler.
122, Liquid Heaters and Vaporizers, appropriate subclasses for a closed liquid heating vessel with a heat generator.
126, Stoves and Furnaces, appropriate subclasses, for open liquid heating structures not equally adapted for cooling, for heating stoves, for means for the application of heat for house warming and cooking purposes, and for specialized accessories and elements of such means.
261, Gas and Liquid Contact Apparatus, appropriate subclasses for apparatus specially adapted to produce an intimate contact between gases and liquids to exchange properties or mutually modify conditions; particularly, subclasses 129+ for gas and liquid contact apparatus having temperature or humidity sensor; subclass 131 for gas and liquid contact apparatus having control of heat supply or heat effect.
- 230 Dewpoint controlled (e.g., control of cooling means by downstream temperature sensor to maintain controlled dewpoint of downstream air, etc.):**
This subclass is indented under subclass 222. Subject matter including a means to control the temperature of the atmosphere so as to produce a vapor saturated or nearly vapor saturated atmosphere.
- SEE OR SEARCH CLASS:
62, Refrigeration, subclass 229 for refrigeration producer having a compressor or its drive controlled by external cooled gas.
- 231 Congealed material (e.g., frost, etc.) or condensation removal or prevention:**
This subclass is indented under subclass 201. Subject matter including a first means responsive to accumulation of congealed material on a surface of the system or on another surface of the heated or cooled area to eliminate such material; or a second means to inhibit freezing or condensation of moisture on said surfaces.
- SEE OR SEARCH CLASS:
62, Refrigeration, subclasses 80 through 82 for refrigeration system having defrosting or frost inhibiting mechanism; subclasses 150 through 156 for refrigeration system having means for preventing, removing, or handling atmospheric condensate.
- 232 Operated by timer or programmer:**
This subclass is indented under subclass 231. Subject matter including a means for measuring or recording time; or a device for controlling the heat transfer apparatus at a predetermined time; or a means for scheduling or coordinating the performance of a repetitive sequence of operations; wherein said means or device selects a period of time that said first or second means operated.

- SEE OR SEARCH CLASS:
62, Refrigeration, subclass 155 for refrigeration system having defrosting means and a time or program actuator.
- 233 Operated by temperature sensor:**
This subclass is indented under subclass 231. Subject matter including a temperature sensing means for controlling the action of said first or second means.
- SEE OR SEARCH CLASS:
62, Refrigeration, subclass 156 for refrigeration system having defrosting means controlled by a temperature sensor.
- 234 Control of static pressure of conditioned space:**
This subclass is indented under subclass 201. Subject matter including a means to control the pressure within the area.
- SEE OR SEARCH CLASS:
52, Static Structures (e.g., Buildings), subclass 1 for static structures controlled by condition responsive means.
236, Automatic Temperature and Humidity Regulation, subclass 49.3 for electrically actuated ventilators.
454, Ventilation, subclasses 70 through 74 for vehicle ventilation system having pressure regulating means; subclasses 238, 255, 340 for ventilation system having pressure regulating means.
- 235 Space is within aircraft:**
This subclass is indented under subclass 234. Subject matter wherein the area is a conditioned space in an aircraft.
- SEE OR SEARCH CLASS:
454, Ventilation, subclasses 71 through 74 for aircraft cabin ventilation system having pressure regulating means.
- 236 Control of heat storage:**
This subclass is indented under subclass 201. Subject matter wherein the system includes a body of material capable of absorbing heat or cold; and a further includes a means to control the amount of heat or cold absorbed.
- SEE OR SEARCH CLASS:
62, Refrigeration, subclass 59 for refrigeration processes including accumulating holdover ice.
- 237 Means responsive to occupancy of space:**
This subclass is indented under subclass 201. Subject matter including means to control the system in response to the presence of a living being in the area.
- 238 Means storing set point for particular time of day (e.g., clock thermostat, etc.):**
This subclass is indented under subclass 201. Subject matter including means for retaining an operating setting for the system and implementing said operating setting at a pre-determined time of day.
- SEE OR SEARCH CLASS:
62, Refrigeration, subclass 157 and 231 for refrigeration system having time or program actuator.
236, Automatic Temperature and Humidity Regulation, subclass 46 for temperature and humidity control devices with timing element.
392, Electric Resistance Heating Devices, subclass 345 for electric resistance heating devices with means to control heating accumulating medium.
- 239 Means to compute time required to reach certain temperature by certain time of day (e.g. morning warm-up, etc.):**
This subclass is indented under subclass 238. Subject matter having additional means to calculate the length of time necessary to attain a given temperature by the predetermined time of day.
- 240 Heat pump and supplemental heat source:**
This subclass is indented under subclass 201. Subject matter wherein said system is a reversible vapor-compression refrigeration producer in which the heating effect of said refrigeration producer is augmented by an additional heat source.
- SEE OR SEARCH CLASS:
62, Refrigeration, subclasses 151 through 56 for refrigeration system having defrosting means; subclass 160 for

- automatic control of refrigeration system of selective heating or cooling (reversible cycle-type); subclasses 238.6 and 238.7 for heat pump.
- 237, Heating Systems, subclass 2 for automatic control of a heat pump.
- 241 Change-over from heat pump operation to supplemental heat source operation alone:**
This subclass is indented under subclass 240. Subject matter including means to convert operation from said reversible refrigeration producer, with or without operation of said additional heat source, to operating in a mode wherein said additional heat source is used exclusively.
- 242 Responsive to outdoor temperature:**
This subclass is indented under subclass 241. Subject matter wherein said converting means reacts to outdoor temperature.
- 243 Means to reset supply air temperature or supply water temperature as function of heat load:**
This subclass is indented under subclass 201. Subject matter wherein the system supplies air or water to heat or cool said area; and wherein means is provided to alter a preset temperature setting of said supply air or water in response to a change in heating or cooling requirement in the area.
- (1) Note. An example of heat load: temperature difference between set point and measured temperature of an area, temperature difference between a chosen reference temperature and a measured outdoor temperature, etc.
- SEE OR SEARCH CLASS:
236, Automatic Temperature and Humidity Regulation, subclass 34 and 36 for automatic control of cooling or heating radiators; subclass 91 for thermostatic control of hot and cold with at least one temperature sensor for temperature modifying media.
- 244 Means to control fan or pump to regulate supply air flow or supply water flow:**
This subclass is indented under subclass 201. Subject matter wherein the system supplies air by a fan or water by a pump to heat or cool said area; and wherein means is provided to alter a characteristic of the fan or pump (e.g., fan speed, volume, etc.) to control the rate at which air or water is delivered to said area.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
50, for room heat exchangers with central fluid supply.
- SEE OR SEARCH CLASS:
236, Automatic Temperature and Humidity Regulation, subclass 49.3 for an electrically actuated ventilator.
417, Pumps, subclasses 1+ for condition responsive control of pump drive motor.
- 245 Low flow during heating and high flow during cooling:**
This subclass is indented under subclass 244. Subject matter wherein the delivered rate is greater during a cooling mode than during a heating mode.
- 246 Responsive to pressure:**
This subclass is indented under subclass 244. Subject matter wherein the delivered rate is varied according to a measured pressure.
- 247 Responsive to temperature:**
This subclass is indented under subclass 244. Subject matter wherein the delivered rate is varied according to a measured temperature.
- 248 Flow of air from outdoors controlled (e.g., minimum outside air, etc.):**
This subclass is indented under subclass 201. Subject matter including a means to regulate the amount of outdoor air admitted to the heated or cooled area.
- SEE OR SEARCH CLASS:
236, Automatic Temperature and Humidity Regulation, subclasses 49.1 through 49.5 for automatic temperature and humidity control of ventilators.
454, Ventilation, subclass 70, 238, 255, and 340 for devices for maintaining the pressure in an enclosure where no specific heating or cooling means are included; subclasses 228+ for ventilating system having forced recirculation; subclass 239 for control of

ventilating system having inlet and outlet airways; subclass 256 for control of ventilating system having inlet airway; and appropriate subclasses for apparatus for supplying air to, removing it from, or distributing air in an enclosure with or without heating and without a specific heat exchange means.

249 Proportion of outdoor air and return air controlled:

This subclass is indented under subclass 248. Subject matter including means to recycle air in the area; and further including means to regulate the ratio of outdoor air relative to an amount of recycle air.

250 Outdoor air used in lieu of operating heating or cooling means (e.g., economy cycle, etc.):

This subclass is indented under subclass 249. Subject matter further including a control means to allow the admittance of substantially one hundred percent outdoor air to condition the area instead of operating a heating or cooling means of said heating and cooling system.

251 Enthalpy sensor:

This subclass is indented under subclass 250. Subject matter and further including a sensor which senses temperature and humidity of air.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, digest 13 for humidithermostat.

252 Pre-heat or pre-cool of outdoor air before mixing with returned air:

This subclass is indented under subclass 248. Subject matter including means to recycle air in the area; and wherein the admitted outdoor air is heated or cooled by passing through a heating or cooling means before mixing with the recycle air in the area.

SEE OR SEARCH CLASS:

62, Refrigeration, subclass 95 for refrigeration processes including plural cooling (e.g., precooling by exhaust, etc.).

253 Temperature sensor controlling temperature:

This subclass is indented under subclass 201. Subject matter including a sensing means for sensing temperature in said area and controlling said system in responsive to said sensed temperature.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, appropriate subclasses for automatic temperature and humidity control mechanisms.

254 System selects heating or cooling mode automatically (e.g., responsive to season, ambient light, temperature in conditioned area, etc.):

This subclass is indented under subclass 253. Subject matter including a means for switching between heating or cooling operation without manual intervention by an operator.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 1 for heating and cooling control devices; subclasses 91+ for thermostatic control of hot and cold.

255 Dead band between heating and cooling:

This subclass is indented under subclass 254. Subject matter including a temperature range about a set point temperature in which neither a heating or a cooling means of said system is activated.

256 Variable rate of heating or cooling (e.g., plural stages, etc.):

This subclass is indented under subclass 254. Subject matter wherein said system is capable of operating to provide variable quantity of heating or cooling energy per unit time to said area.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclasses 1+ for multi-stage control devices.

- 257 Room and ambient temperature sensors:**
This subclass is indented under subclass 254. Subject matter including a temperature sensor in said area and further including an outdoor temperature sensor.
- SEE OR SEARCH CLASS:
236, Automatic Temperature and Humidity Regulation, subclass 91 for automatic thermostatic control of heating and cooling; subclass 91 for automatic thermostat control of hot and cold for plural rooms or plural outside thermostats.
- 258 Separate heating and cooling thermostats:**
This subclass is indented under subclass 254. Subject matter including a first device which measures changes in temperature and controls a heating means; and a second device which measures changes in temperature and controls a cooling means to maintain desired temperature.
- SEE OR SEARCH CLASS:
236, Automatic Temperature and Humidity Regulation, subclass 1 for heating and cooling control devices.
- 259 Single temperature sensing means:**
This subclass is indented under subclass 254. Subject matter wherein said switching means comprises only one temperature sensor.
- SEE OR SEARCH CLASS:
236, Automatic Temperature and Humidity Regulation, subclass 1 for heating and cooling control devices.
- 260 Variable rate of heating or cooling (e.g., plural stages, etc.):**
This subclass is indented under subclass 253. Subject matter wherein said system is capable of operating to provide variable quantity of heating or cooling energy per unit time to said area.
- SEE OR SEARCH CLASS:
236, Automatic Temperature and Humidity Regulation, subclasses 1+ for multi-stage control devices.
- 261 Sequentially activated heat sources or cool sources:**
This subclass is indented under subclass 260. Subject matter including a plurality of heating means initiated one after another or a plurality of cooling means initiated one after another.
- 262 Timer:**
This subclass is indented under subclass 261. Subject matter wherein said plurality of heating or cooling means are operated by a means for measuring or recording time, or by a device for controlling the heat transfer apparatus at a pre-determined time.
- 263 Area receives conditioning from simultaneously operated heating and cooling means(e.g., opposed and compensating heating and cooling, etc.):**
This subclass is indented under subclass 253. Subject matter wherein means supplying heating and means supplying cooling operates at the same time and both supplies their respective output to the same area.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
215, for a heat exchange apparatus with reheat adjacent zone air inlet.
- 264 Simultaneous heating and cooling only in limited range around set point temperature:**
This subclass is indented under subclass 263. Subject matter wherein the area is heated and cooled at the same time only when a measured temperature is within a limited range around a pre-determined desired temperature.
- 265 Manual changeover between heating and cooling modes (e.g., manual override, etc.):**
This subclass is indented under subclass 253. Subject matter including a means for allowing an operator to switch between heating and cooling operations.
- SEE OR SEARCH CLASS:
62, Refrigeration, subclasses 161 through 164 for a refrigeration system having correlated manual or external operator and condition sensing means (e.g., cut off or reset, etc.).

266 Preheat or pre-cool of space or device during start-up:

This subclass is indented under subclass 200. Subject matter wherein the heat transfer apparatus effects a temperature change in an occupied space or during use of a device and wherein there is further included a means to attain a pre-determined temperature immediately prior to occupancy of the space or use of the device.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclasses 46+ for automatic temperature and humidity control devices with timing element.

267 Means to heat or cool for predetermined periods of time (e.g., duty cycle, time-temperature profiler, etc.):

This subclass is indented under subclass 200. Subject matter wherein said instrument controls the heat transfer apparatus to cause the apparatus to operate for a pre-set interval of time.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 46 for automatic temperature and humidity control devices with timer other than clock.

268 Pre-determined time variable set point:

This subclass is indented under subclass 267. Subject matter wherein said instrument further includes a means to set a pre-determined time varying set-point for said heat transfer apparatus to cause the apparatus to follow the set point during said pre-set interval of time.

269 Duty cycle (e.g., pulse duration or pulse frequency modulation, etc.):

This subclass is indented under subclass 267. Subject matter wherein said instrument outputs a plurality of electrical pulses to actuate the heat transfer apparatus in a pulsed manner, said pulses being of extremely short duration (e.g., less than one second, etc.) and the frequency, duration or ratio of on-to-off time of the pulse within a given time interval is controlled by the instrument.

SEE OR SEARCH CLASS:

236, Automatic temperature and humidity regulation, subclass 46 for automatic temperature and humidity control devices with timer other than clock.
251, Valves and Valve Actuation, subclass 129.05 for electrically actuated valves having means to produce digital pulses.

270 Time delay:

This subclass is indented under subclass 200. Subject matter wherein said instrument accepts an input signal and waits for a time interval before initiating an output signal.

SEE OR SEARCH CLASS:

62, Refrigeration, subclass 158 for a refrigeration system having time delay of condition sensing or control operation.

271 Vehicle or engine speed responsive:

This subclass is indented under subclass 200. Subject matter wherein said instrument senses and reacts to the velocity of a vehicle or vehicle engine.

SEE OR SEARCH CLASS:

62, Refrigeration, subclasses 133+ for a refrigeration system responsive to vehicle body motion or traction.

272 Control of heat pipe heat transfer characteristics:

This subclass is indented under subclass 200. Subject matter wherein said heat transfer apparatus comprises a substantially sealed cavity containing a liquid, heat being absorbed in one portion of said cavity by vaporization of the liquid and released in a second portion of said cavity by condensation of the vapor, the condensed vapor being recycled for subsequent evaporation; and further including means to control the vaporization, condensation or recycling.

273 Control of quantity of inert gas:

This subclass is indented under subclass 272. Subject matter including a means to control the amount of inert gas present within said cavity.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

104.32, for heat exchange apparatus having intermediate liquid fluent heat exchange material with pressurizing or degassifying means; subclasses 281+ for heat exchange apparatus having fluid pressure responsive or control.

274 Control of vapor or liquid flow between evaporator and condenser sections (e.g., by variable restrictions, check valves, etc.):

This subclass is indented under subclass 272. Subject matter wherein the control means controls the transport of vapor from said one portion to said second portion or the transport of recycled liquid from said second portion to said first portion.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

104.22+, for heat exchange apparatus having intermediate liquid fluent heat exchange material utilizing change of state and including means to move the heat exchange material in liquid state.

275 Control of amount of conductive gas in confined space between heat source and heat sink:

This subclass is indented under subclass 200. Subject matter wherein said heat transfer apparatus comprises a substantially sealed cavity containing a gas which does not change phase during operation of said apparatus, heat being conducted through said gas from one portion of said cavity to a second portion of said cavity; and further including means to control the quantity of said gas within said cavity.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

104.32, for heat exchange apparatus having intermediate liquid fluent heat exchange material with pressurizing or degassifying means; subclasses 281+ for heat exchange apparatus having fluid pressure responsive or control; subclass 917 for heat exchange apparatus having pressurization and/or degassification.

276 Control of variable thermal conductivity systems (e.g., heat valves, etc.):

This subclass is indented under subclass 200. Subject matter wherein said heat transfer apparatus comprises a gaseous, liquid or solid heat conductive path between a heat source and a heat sink; and further including means to control the thermal conductivity of said path (e.g., by severing the conductive path or by changing its cross-sectional area, electrically charging said path, etc.)

SEE OR SEARCH THIS CLASS, SUB-CLASS:

86+, for heat exchange apparatus having movable heating or cooling surface; subclasses 96+ for heat exchange apparatus with adjustor for heat flow or for heat exchange material flow; subclass 185 for heat transmitter.

277 Solid heat transfer path:

This subclass is indented under subclass 276. Subject matter wherein said heat conductive path is formed by a solid material.

278 Vent of system (e.g., overpressure, overtemperature, removal of noncondensable, etc.):

This subclass is indented under subclass 200. Subject matter wherein said heat transfer apparatus includes a confined volume containing a heat transfer fluid within; and further including means to allow the escape of fluid from said confined volume.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

71, for heat exchange apparatus with purge, or drainage, cock or plug; subclass 104.32 for heat exchange apparatus having intermediate liquid fluent heat exchange material with pressurizing or degassifying means; subclass 917 for heat exchange apparatus having pressurization and/or degassification.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 92 for thermostatic control of hot and cold with diverse sensor (e.g., humidity, pressure, etc.).

- 279 **Pressure and temperature responsive or control:**
This subclass is indented under subclass 200. Subject matter wherein the heat transfer apparatus has control means reacting to both pressure and temperature conditions or controlling both pressure and temperature conditions of the heat transfer apparatus.
- SEE OR SEARCH CLASS:
236, Automatic Temperature and Humidity Regulation, subclass 92 for thermostatic control of hot and cold with diverse sensor (e.g., humidity, pressure, etc.), subclass 92 for thermostatic control of heating and cooling.
- 280 **Bypass of heat exchanger responsive to both temperature and pressure:**
This subclass is indented under subclass 279. Subject matter wherein the heat transfer apparatus comprises a heat exchanger having a fluid passing through it and an auxiliary passageway in parallel flow connection with the heat exchanger to permit the fluid to go around rather than through the heat exchanger, the auxiliary passageway having a means to control flow through it which is responsive to both temperature and pressure.
- SEE OR SEARCH CLASS:
236, Automatic Temperature and Humidity Regulation, subclass 34.5 for automatic temperature and humidity control of cooling radiator having bypass; subclasses 92+ for thermostatic control of hot and cold with pressure control.
- 281 **Fluid pressure responsive or control:**
This subclass is indented under subclass 200. Subject matter wherein the heat transfer apparatus includes a heat exchange fluid, and further includes means to control the pressure of such fluid, or wherein the heat transfer apparatus includes a device responsive to fluid pressure to control the apparatus.
- SEE OR SEARCH CLASS:
236, Automatic Temperature and Humidity Regulation, subclasses 92+ for thermostatic control of hot and cold with pressure control; appropriate sub-
- classes for automatic temperature and humidity control devices.
- 282 **Branched flow of heat exchange material:**
This subclass is indented under subclass 281. Subject matter wherein the heat transfer apparatus comprises a main conduit for the flow of a heat exchange fluid, the main conduit being divided at a predetermined location into at least two sub-conduits, each of the sub-conduits being in parallel flow relation with the other.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
101, for heat exchange apparatus having control of flow through parallel heating or cooling means.
- 283 **Bypass of heat exchanger:**
This subclass is indented under subclass 282. Subject matter wherein one of the sub-conduits is connected to a heat exchanger and the other sub-conduit is an auxiliary passageway to permit the fluid to go around rather than through the heat exchanger.
- SEE OR SEARCH CLASS:
236, Automatic Temperature and Humidity Regulation, subclass 34.5 for automatic temperature and humidity control of cooling radiator having bypass.
- 284 **Differential pressure operated bypass:**
This subclass is indented under subclass 283. Subject matter wherein the auxiliary passageway has a means to control flow through it which is responsive to the existence of a fluid pressure differential between an inlet and an outlet end of the auxiliary passageway.
- 285 **Flow of one heat exchange material controlled by the pressure of another:**
This subclass is indented under subclass 281. Subject matter wherein the heat transfer apparatus has first and second fluids flowing through it and the amount of the first fluid flowing through the heat transfer apparatus is controlled by the pressure of the second fluid.
- 286 **Flow of one heat exchange material controlled by its own pressure:**
This subclass is indented under subclass 281. Subject matter wherein the heat transfer apparatus has a fluid flowing through it and the

amount of the fluid flowing through the heat transfer apparatus is controlled by its own pressure.

287 Temperature responsive or control:

This subclass is indented under subclass 200. Subject matter wherein the heat transfer apparatus has control means reacting to a temperature level or controlling a temperature level of the heat transfer apparatus.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclasses 91+ for thermostatic control of hot and cold; appropriate subclasses for automatic temperature and humidity control devices; subclasses 99+ for automatic temperature and humidity control devices associated with system having expanding fluid.

288 Plural temperature sensors:

This subclass is indented under subclass 287. Subject matter wherein said control means is connected to more than one means to sense temperature.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 78 for automatic temperature and humidity control devices associated with electric motors and having plural temperature sensors; subclass 80 for automatic temperature and humidity control devices associated with fluid operated motors and having plural temperature sensors; subclass 99 for automatic temperature and humidity control devices associated with system having expanding fluid and having external and internal sensors.

289 Means to maintain a constant temperature difference between a measured temperature and a controlled temperature:

This subclass is indented under subclass 288. Subject matter wherein a first of sensor means measures temperature at a first location and a second of said sensor means measures temperature at a second location; and wherein said controller is operated to maintain the temperature at said second location at a pre-determined

difference in value with respect to said temperature at said first location.

290 Temperature sensor within or near an area to be conditioned, another temperature sensor near the conditioning equipment (e.g., shallow/deep, etc.):

This subclass is indented under subclass 288. Subject matter wherein one temperature sensing means is located at or in close proximity to an area whose temperature is to be controlled, and wherein another temperature sensing means is located in close proximity to a means used to thermally condition the temperature controlled area.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 91 for automatic temperature and humidity control devices associated with plural rooms or plural outside thermostats.

291 Temperature sensor inside conditioned space, another temperature sensor outdoor (e.g. indoor set point adjusted by outdoor conditions, etc.):

This subclass is indented under subclass 288. Subject matter wherein one temperature sensing means is located within an area to be conditioned, and another temperature sensing means is located outdoors.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 68 for automatic temperature and humidity control devices associated with motors and auxiliary heater applied to main temperature sensing means; subclass 68 for automatic temperature and humidity control devices associated with motors and auxiliary heater applied to control device away from main temperature sensor; subclass 91 for automatic temperature and humidity control devices associated with plural rooms or plural outside thermostats.

292 Temperature sensor in treated fluid, another temperature sensor in treating fluid:

This subclass is indented under subclass 288. Subject matter wherein the heat transfer apparatus comprises a heat exchanger having a

treated fluid and a treating fluid in heat exchange relationship with one another, wherein one temperature sensing means measures treated fluid temperature and another temperature sensing means measures treating fluid temperature.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 91 for thermostatic control of hot and cold with at least one temperature sensor.

293 Temperature sensor prior to heat exchanger and one after:

This subclass is indented under subclass 288. Subject matter wherein the heat transfer apparatus comprises a heat exchanger having a fluid flowing through it and wherein one temperature sensing means is located upstream of the heat exchanger and another temperature sensing means is located downstream of the heat exchanger.

294 Branched flow of heat exchange material:

This subclass is indented under subclass 288. Subject matter wherein the heat transfer apparatus comprises a main conduit for the flow of a heat exchange fluid, the main conduit being divided at a predetermined location into at least two subconduits, each of said subconduits being in flow relation with the other.

SEE OR SEARCH THIS CLASS, SUBCLASS:

101, for heat exchange apparatus having tortuous and straight through branches within heating or cooling drum.

295 Including mass flow sensor:

This subclass is indented under subclass 287. Subject matter and further including a means to measure the quantity of fluid flowing through or around the heat transfer apparatus.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 9 for combined heating and apartment control with heating medium circulation control.
374, Thermal Measuring and Testing, subclass 40 and 41 for a device associated with measurement of a quantity of heat which is determined by com-

bining flow rate and temperature signals of a heat exchange fluid.

296 Branched flow of heat exchange material:

This subclass is indented under subclass 287. Subject matter wherein the heat transfer apparatus comprises a main conduit for the flow of a heat exchange fluid, the main conduit being divided at a predetermined location into at least two subconduits, each of said subconduits being in flow relation with the other.

SEE OR SEARCH THIS CLASS, SUBCLASS:

101, for heat exchange apparatus having tortuous and straight through branches within heating or cooling drum.

297 Bypass of heat exchanger:

This subclass is indented under subclass 296. Subject matter wherein one of the subconduits is connected to a heat exchanger and the other subconduit is an auxiliary passageway to permit the fluid to go around rather than through the heat exchanger.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 34.5 for automatic temperature and humidity control of cooling radiator having bypass.

298 Mixture temperature sensing:

This subclass is indented under subclass 297. Subject matter wherein the auxiliary passageway branches ahead of, and recombined after, the heat exchanger and wherein the flow through the auxiliary passage or heat exchanger is controlled by the temperature of the recombined stream.

SEE OR SEARCH CLASS:

137, Fluid Handling, subclasses 88+ for a fluid handling system having mixture condition maintaining or sensing.
236, Automatic Temperature and Humidity Regulation, subclasses 12.1+ for control devices associated with mixing fluids of dissimilar temperatures.

299 Flow of one heat exchange material controlled by temperature of another:

This subclass is indented under subclass 287. Subject matter wherein the heat transfer apparatus has first and second fluids flowing through it and the amount of the first fluid flowing through the heat transfer apparatus is controlled by the temperature of the second fluid.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, appropriated subclasses for automatic temperature and humidity control devices.

300 Flow of one heat exchange material controlled by its own temperature:

This subclass is indented under subclass 287. Subject matter wherein the heat transfer apparatus has a fluid flowing through it and the amount of the fluid flowing through the heat transfer apparatus is controlled by its own temperature.

SEE OR SEARCH CLASS:

62, Refrigeration, subclass 527, 528 for evaporator having flow controller or boiling expeditor.
236, Automatic Temperature and Humidity Regulation, subclasses 93+ for thermostatic devices associated with controlling of fluid; and appropriated subclasses for automatic temperature and humidity control devices.

301 Liquid-level responsive or control means:

This subclass is indented under subclass 200. Subject matter wherein said instrument senses and reacts to the height of liquid contained in a liquid holder or regulates said height.

SEE OR SEARCH CLASS:

122, Liquid Heaters and Vaporizers, subclasses 451+ for automatic control of feeders.
137, Fluid Handling, subclass 11 for processes related to regulating boiler feed water level.

302 Condenser or evaporator:

This subclass is indented under subclass 301. Subject matter wherein said heat transfer apparatus is a device structured to convert gas to liquid by reducing its temperature or to convert liquid to gas by addition of heat.

SEE OR SEARCH THIS CLASS, SUBCLASS:

110+, for heat exchange apparatus having first fluid holder or collector open to second fluid.

SEE OR SEARCH CLASS:

62, Refrigeration, subclass 527 and 528 for evaporator having flow controller or boiling expeditor.

303 Cleaning:

This subclass is indented under subclass 200. Subject matter wherein said instrument controls a means for cleaning said heat transfer apparatus.

SEE OR SEARCH THIS CLASS, SUBCLASS:

95, for heat exchange apparatus having cleaning means.

SEE OR SEARCH CLASS:

15, Brushing, Scrubbing, and General Cleaning, subclasses 3.5+ for cleaning means having means to pass a solid cleaning agent and a fluid carrier through tubular work; subclasses 301+ for installed cleaners involving no modification of the heat exchanger; subclasses 104.03+ for pipe and tube cleaning implements.
134, Cleaning and Liquid Contact With Solids, appropriate subclasses for cleaning apparatus of more general utility.

CROSS-REFERENCE ART COLLECTIONS**900 COOLING TOWERS:**

Apparatus which cool fluid by indirect heat exchange with outside air.

901 HEAT SAVERS:

Apparatus which heats air with the waste heat of domestic flue gases.

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| <p>902 HEAT STORAGE:
Apparatus to store heat other than where provided in class.</p> <p>903 CONVECTION:
Apparatus having structure peculiar to modifying convection characteristics.</p> <p>904 RADIATION:
Apparatus having structure peculiar to modifying radiation characteristics.</p> <p>905 MATERIALS OF MANUFACTURE:
Apparatus constructed of special materials.</p> <p>906 REINFORCEMENT:
Apparatus having structure reinforcing an element of the heat exchanger.</p> <p>907 POROUS:
Apparatus having a porous heat exchange element.</p> <p>908 FLUID JETS:
Apparatus having structure to form fluid jets to enhance heat transfer.</p> <p>909 REGENERATION:
Apparatus recovering waste heat.</p> <p>910 TUBE PATTERN:
Apparatus having specific tube spacing relationships.</p> <p>911 VAPORIZATION:
Apparatus having vaporization modifying structure.</p> <p>912 COMBINED OR CONVERTIBLE HAT EXCHANGE MODES:
Apparatus which has multiple heat exchange modes.</p> <p>913 CONDENSATION:
Apparatus having condensation modifying structure.</p> <p>914 FILMING:
Apparatus having means to form a film on the heat exchange surface.</p> | <p>915 FOAMING:
Apparatus having means to form a foam on the heat exchange surface.</p> <p>916 OIL COOLER:
Apparatus for cooling oil.</p> <p>917 PRESSURIZATION AND/OR DEGASSIFICATION:
Apparatus having means to pressurize or degasify the heat exchange fluid.</p> <p>918 HEATED AND COOLED FOOD CABINETS AND/OR TRAYS:
Apparatus for maintaining food in a heated or cooled condition.</p> <p>919 Wheeled:
This subclass is indented under subclass 918. Apparatus including wheeled movement means on cabinets or trays.</p> <p>920 PARTICULATE HEAT EXCHANGE:
Apparatus exchanging heat indirectly with particular material.</p> <p>921 DEW POINT:
Apparatus in which gas stream flow temperature is manipulated relative to the dew point of the gas stream.</p> |
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FOREIGN ART COLLECTIONS

The definitions for FOR 100-FOR 131 below correspond to the definitions of the abolished subclasses under Class 165 from which these collections were formed. See the Foreign Art Collections schedule for specific correspondences. [Note: The titles and definitions for indented art collections include all the details of the one (s) that are hierarchically superior.

FOR 100

Foreign art collections under the class definition.

FOR 101

Foreign art collections for (1) heating at one time and cooling at another, (2) for both adding heat to and removing it from the same material and (3) for separately heating and cooling distinct external materials.

FOR 102

Foreign art collections wherein water vapor is added to or removed from air.

FOR 103

Foreign art collections whereby (1) the time in which, or length of time taken, to perform an operation is controlled, (2) there is a fixed continuous sequential or fixed repetitive operation by means performing a treating operation, or (3) there is a means terminating a single operation in a position to restart an additional cycle, which cycle is more complex than a mere starting or stopping of a single device.

FOR 104

Foreign art collections comprising means to sense an operating condition or change of operating condition and exert a control on heating or cooling means or on means handling material acted in or to be acted upon by the heating or cooling means.

FOR 105

Foreign art collection in which the control acts in a system operative to both heat and cool a material external of the system.

FOR 106

Foreign art collections in which the pressure of a heated and cooled enclosure is controlled.

FOR 107

Foreign art collections in which there is a control of the supply of fresh air.

FOR 108

Foreign art collection responsive to the accumulation of congealed material to eliminate such material.

FOR 109

Foreign art collections with an additional body of heat absorbing material spaced therefrom that controllable temporarily stores heat.

FOR 110

Foreign art collections controlling the flow of the gas or liquid in a gas and liquid contact device.

FOR 111

Foreign art collections responding to water vapor in the air.

FOR 112

Foreign art collections which senses and effects a control of the humidity.

FOR 113

Foreign art collections wherein the interaction of the individual controls for a plurality of zones effects a control action on a central heating and cooling system.

FOR 114

Foreign art collections responsive to any phase of motion of a vehicle.

FOR 115

Foreign art collections wherein manually operated means is so related to an automatic control as to modify the manner of operation of the automatic control.

FOR 116

Foreign art collections wherein the manually operated means modifies the automatic control in providing for heating or cooling.

FOR 117

Foreign art collections comprising a single condition sensor.

FOR 118

Foreign art collections comprising selective heating-cooling means.

FOR 119

Foreign art collections including sensors that respond to both the temperature within and the temperature without an enclosure.

FOR 120

Foreign art collections in which the heating effect of a heat pump is augmented by a heat source under the control of a condition sensor.

FOR 121

Foreign art collections in which a substance is subjected to simultaneous heating and cooling and in which either the heater or cooler is controlled by a condition sensor.

FOR 122

Foreign art collections where the control is of or by pressure.

FOR 123

Foreign art collections including pressure or temperature control or response.

FOR 124

Foreign art collections having a manually actuated device in the control structure.

FOR 125

Foreign art collections wherein the control is of the verging of exchange fluid.

FOR 126

Foreign art collections in which a line branches ahead of, and recombines after, a heat exchange section.

FOR 127

Foreign art collections in which the system is controlled by temperature of the recombined stream.

FOR 128

Foreign art collections also responsive to pressure.

FOR 129

Foreign art collections responsive to pressure.

FOR 130

Foreign art collections responsive to one exchanging substance controlling the flow of fluid with which it exchanges heat.

FOR 131

Foreign art collections responsive to a flowing stream of heat exchanging fluid controlling the flow of the stream.

END